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STATE OF CALIFORNIA

FISH AND GAME COMMISSION

TWENTY-FIFTH BIENNIAL REPORT

For the Years 1916-1918



CALIFORNIA STATE PRINTING OFFICE

SACRAMENTO

1918

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LETTER OF TRANSMITTAL.

SAN FRANCISCO, CALIFORNIA,
July 1, 1918.

*To His Excellency WILLIAM D. STEPHENS,
Governor of the State of California,
Sacramento, Cal.*

SIR: In accordance with section 332 of the Political Code of the State of California we submit for your consideration the twenty-fifth biennial report of the Fish and Game Commission. Herein you will find a brief account of the activities of this commission for the period July 1, 1916, to June 30, 1918, together with an accounting of all funds handled. War-time economy has precluded a more elaborate report. Further details of our work can be obtained from volumes 3 and 4 of CALIFORNIA FISH AND GAME, the quarterly publication bearing the motto "Conservation through education," which has been issued regularly by the commission since October, 1914.

There has been one change in the personnel of the commission since the last biennial report. On December 8, 1916, Mr. Edward L. Bosqui of San Francisco was appointed Fish and Game Commissioner to succeed Mr. Carl Westerfeld who was elected at that time to the office of Executive Officer. The resignation of Mr. Ernest Schaeffle, formerly executive officer, occasioned the change.

Respectfully submitted.

(Signed) F. M. NEWBERT, *President.*

(Signed) M. J. CONNELL.

(Signed) E. L. BOSQUI.

By CARL WESTERFELD,
Executive Officer.

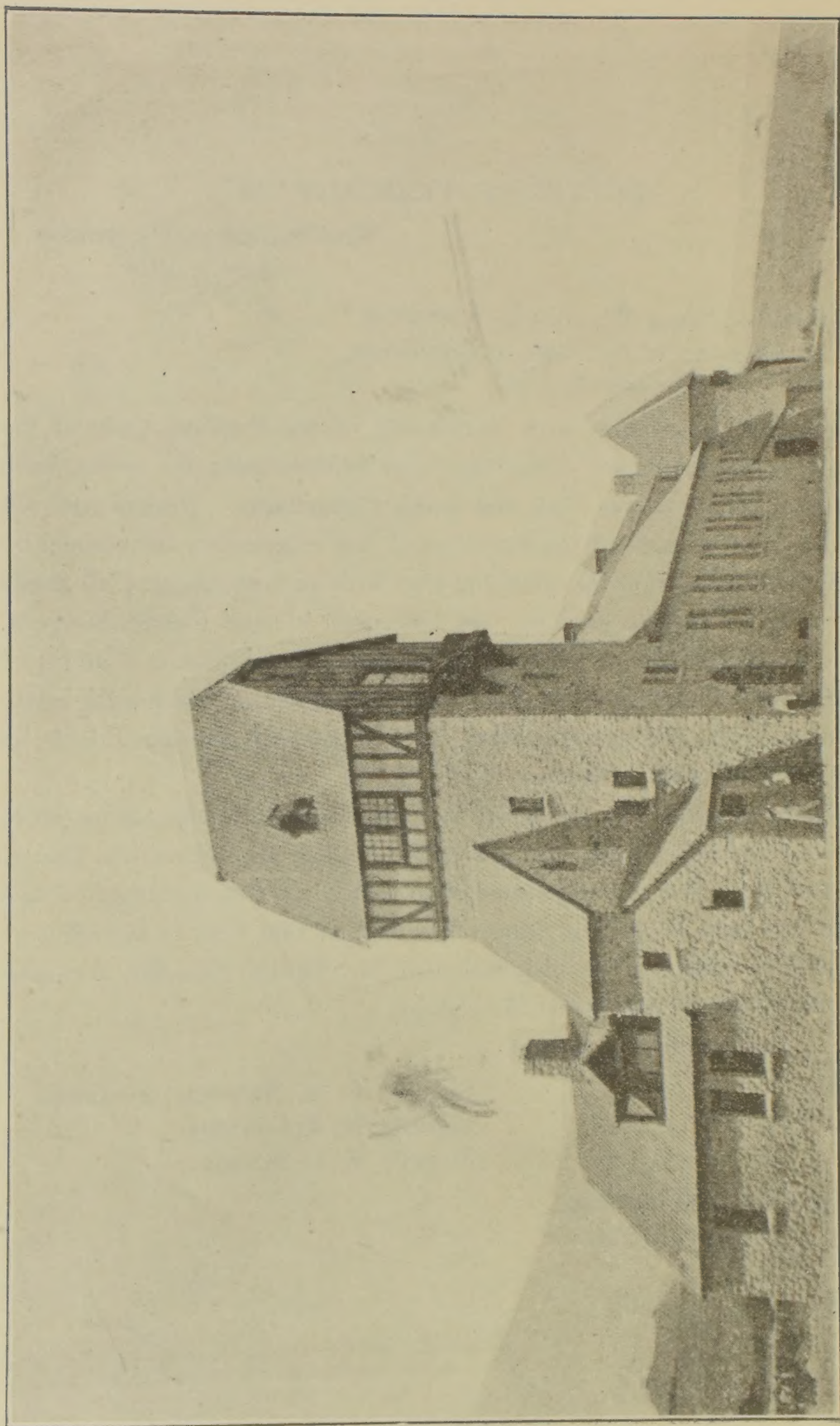


Fig. 1. Mt. Whitney Hatchery near Independence, Inyo County, California. This splendid stone building is one of the most imposing of the state buildings. Most of the streams of the southern Sierras and southern California will be stocked from this new hatchery. Photograph by Carl Westerfeld.

TWENTY-FIFTH BIENNIAL REPORT.

The duties of the Board of Fish and Game Commissioners, as listed in the Political Code, are: the strict enforcement of the laws for the protection and preservation of wild animals, wild birds, fishes, mollusks, crustacea and other forms of aquatic animals and plants, the inspection of the storage and transportation of fish and game, the establishment and maintenance of fish hatcheries, the stocking of streams with fish, the construction and repair of fish ladders and screens, and the propagation, distribution and protection of game birds and animals. All of these duties have been performed to the best of our ability with the means at hand.

In reviewing the work we find that the past biennial period has been one of widened activities, increased results and better enforcement of the fish and game laws. At the present, however, we are entering a period of marking time. War-time conditions demand economy. However, there should be no relaxation or reduced efficiency, and increased watchfulness is necessary to prevent a tearing down of the protective laws relating to fish and game. It is a period of danger. Already there have been numerous attempts by commercial interests to shelve protective laws, and if food conditions should become still more serious, it will become increasingly difficult to prevent dangerous inroads being made on our fish and game. This must be a time of organizing forces for the defense, lest commercial interests break down all that has been erected for the protection of our wild life. The new federal legislation relating to insectivorous and migratory birds has come at an opportune time and will be of great assistance in preventing the enemies of game from getting the upper hand.

The outstanding features of the past biennial period have been the erection of a splendid new hatchery in Inyo County, the building of a new patrol boat to be used in enforcing the laws in southern California waters and in carrying on fishery investigations, the enlargement of the activities of the Commercial Fisheries Department, including the administration of the kelp industry, the extensive educational and publicity campaign which has been carried on, and the splendid results obtained in enforcing fish and game laws.

New laws enacted by the 1917 legislature are proving valuable. The trapper's license law was well received by the trappers, and the provisions of the law are sure to increase the take of furs and at the same time give needed protection to fur-bearing animals. The new game breeder's law is a great improvement on the old one, but very few have

attempted the domestication of wild game. The Supreme Court decision, upholding the state law prohibiting parcel post shipments of game, has effectually stopped a much-used method of evading the law. The wisdom of passing a spiked buck law is becoming more and more apparent. An increase in the number of deer and a reduced number of hunting accidents are direct results of this law.

Satisfactory game conditions prevail. The yearly kill of deer continues to be near the 12,000 mark, and excellent waterfowl shooting has been enjoyed up to this last year, when unusual weather conditions interfered. With the change in the quail season improved quail hunting should result. The new federal regulations will benefit dove conditions by preventing the destruction of nesting birds during August.

Game Refuges.

Believing that the game refuge forms one of the most dependable means of conserving the game supply, the commission was instrumental in having the 1917 legislature set aside 16 large areas within the national forests as game refuges. The new refuges are as follows:

Name	County	Area, acres
4E -----	San Diego -----	51,840
4D -----	Riverside -----	69,120
3D -----	Ventura -----	125,440
3C -----	Santa Barbara -----	39,680
1L -----	Tulare and Kern -----	37,600
1K -----	Fresno -----	33,400
1J -----	Amador -----	57,600
1I -----	El Dorado -----	64,000
1H -----	Plumas -----	31,000
1G -----	Tehama -----	34,400
1F -----	Lassen -----	47,580
1C -----	Modoc -----	47,560
1B -----	Modoc -----	57,000
1E -----	Shasta -----	69,000
1A -----	Siskiyou -----	8,960
2A -----	Mendocino and Lake -----	37,000
Mount Tamalpais -----	Marin -----	28,000
Total -----	-----	839,180

The United States Forest Service greatly aided in picking out the areas. Each refuge was chosen with reference to the various kinds of game to be found, where both summer and winter range is provided and where administration is easily possible. With these new refuges and those which have already been set aside, and with the national parks, which are federal refuges, California now has a chain of sanctuaries extending from the Mexican line to the Oregon line. It is becoming more and more apparent that the protection afforded in a refuge allows game to increase rapidly and spread out to surrounding territory where it furnishes food and sport to all those who wish.

Another encouraging feature is that so long as these refuges remain inviolate it will be practically impossible to exterminate the larger game animals.

Fishculture.

During the past two years our Department of Fishculture has had in operation twelve hatcheries and nine egg-collecting stations. The output of the hatcheries has been very gratifying. A 16 per cent increase in the number of trout fry reared is to be noted, the total output being 35,058,000. These millions of trout were successfully planted in the streams of the state by means of our distribution cars and auto trucks. The output of the Mount Shasta Hatchery will compare favorably with that of any trout hatchery in the world. The limit capacity of trout fry that can be successfully reared at this hatchery is about ten million. In 1916, 9,377,000 trout fry were distributed from this hatchery, and in 1917 the total was 9,972,000.

Experiments started several years ago have proved that the steelhead trout will do well in lakes in the interior. As a consequence it will be safe to plant trout of this variety in the mountain districts and increased numbers of this variety will be reared in the future. In order to increase the output of Eastern brook trout, arrangements were made with the Nevada Fish Commission to operate the Marlette-Carson Hatchery. As a result 577,000 additional Eastern brook fry were planted in 1916 and 200,000 additional in 1917. For the first time golden trout have been propagated. At an egg-collecting station established at Cottonwood Lakes 500,000 golden trout eggs were taken in 1918. These eggs were successfully hatched at the Mount Whitney Hatchery.

Although less salmon were hatched during the past biennial period, the output of the California hatcheries amounted to 25,701,000. Splendid results have been obtained from the pond system installed. Although in the past we have relied largely upon salmon eggs furnished us by the United States Bureau of Fisheries, we will in the future obtain the larger proportion of the eggs ourselves. An egg-collecting station has been established at Bryan's on the Eel River, and next year we will take over the Bureau of Fisheries' Station on the Klamath River.

Shad were propagated for the first time during the spring of 1916, when a hatchery was established at Yuba City. A total of 872,000 shad fry were planted in the Feather River as a result of the season's operations.

The completion and successful operation of the Mount Whitney Hatchery in Inyo County has solved the distribution problem in south-

ern California. From this splendid new hatchery it is possible to stock a large part of the southern Sierras and southern California. The egg-collecting stations at Rae Lakes and Cottonwood Lakes will furnish a plentiful supply of eggs.

The present finds our hatcheries and egg-collecting stations in a fair condition of repair. In a few instances additions and repair work is necessary.

In that the problem of transportation has become increasingly difficult to solve, owing to the great distances between the larger hatcheries and the streams in which fish are to be planted, we have decided upon a new policy. In the future a number of small hatcheries will be erected in suitable locations near the streams to be stocked, with the result that the fry will only have to be moved a short distance. Transportation in most instances can be cared for by auto trucks. The temporary hatchery placed on the Feather River and the contemplated Yosemite Hatchery form part of this proposed plan.

The first hatchery under the new law which provides that companies building dams over which fishways can not be constructed must establish a fully equipped hatchery, is being built. The California-Oregon Power Company will comply with all the provisions of the law and will establish a hatchery on Fall Creek, together with cottages for attendants, racks and traps, which will cost approximately \$20,000.

A great deal has been accomplished in preventing pollution of state waters. Through our efforts much of the waste which heretofore was allowed to pass into state waters has been saved and treated for more valuable by-products, at the same time saving fish from destruction. Some of the larger quartz and copper mines have constructed dams to impound waste. Notably the Engels Copper Mine of Plumas County has spent \$25,000 on work of this kind. An endeavor to stop the pumping of bilge water in the vicinity of the Farallon Islands, which resulted in the destruction of bird life, was successful.

We have continued to enforce the screening of irrigation ditches with the result that hundreds of screens have been installed during the past biennium. Several large irrigation ditches have been successfully screened with a rotary screen of large design, and a new "draper" type of screen, invented by a former employee of this commission, has also proved successful in large ditches. Fifty-five different fishways have been surveyed, constructed and repaired during the past two years.

Commercial Fisheries.

The Department of Commercial Fisheries has felt that no more important work could be done at this time than the gathering of accurate statistical data on the state fisheries. All future regulation of

the fisheries must depend upon accurate data as to the individual boat catch of each variety of fish. Although a law passed by the 1917 legislature provided for the securing of data, it was not until the Food Administration demanded information on the catch of fish that a suitable system for securing it was worked out. Now two carbon copies of the receipts issued to fishermen by dealers are made, and one of these is the property of the state. From these receipts a record as to the catch of each boat is made available. To facilitate the gathering of statistics, branch offices have been established at San Pedro and San Diego, and additional help secured.

The need of a patrol boat for southern California, in order that the fisheries laws might be properly enforced and investigations of the fisheries made, quickly became evident. As a result, the 60-foot sea-going patrol boat "Albacore" was constructed (Fig. 6). Important scientific investigations are also made possible with this fully equipped boat.

Scientific investigations of the fisheries have been begun, with Mr. W. F. Thompson in charge. Valuable light on the habits and life history of the albacore (tuna) has been the result. Investigations of the herring and the sardine industry are now being undertaken. The need for a wider utilization of fish other than those commonly used for food is needed in war times. A publicity campaign to induce people to eat the less-known fish has formed a part of the work of the fisheries department. Emphasis must be placed on reforms in handling the fish if people are to be induced to eat more fish.

The kelp industry continues to grow. A satisfactory method of apportioning the beds has been worked out and the income from the tax is being utilized largely in investigational work. It seems probable that this new industry will be able to continue even after the price of potash falls at the end of the war.

During the past biennial period the sardine industry has taken the leading place among the fisheries of our state. The catch of sardines in 1917 was a little over 106,000,000 pounds, which was 10,000,000 pounds more than the total catch of all fish in 1916. Over 1,000,000 cases of sardines were packed in 1917 as the output of 30 canneries.

It can be seen, therefore, that the fisheries of our state are growing rapidly and that care must be taken that the supply is kept up by judicious administration.

Education and Publicity.

No better evidence of the results to be expected from a well organized educational and publicity campaign has come to our notice than the activities of the United States Food Administration. Even without

laws. Mr. Hoover, by showing the need and wisdom of eating certain kinds of food, has successfully conserved the necessary food supply. Furthermore, a most splendid co-operation on the part of citizens is to be noted; in some measure, doubtless, due to the fact that they have never been forced to conserve the food supplies but only shown the need for doing so. If this method brings success in conserving food supplies, why can it not also prove successful in conserving wild life? Certainly, the government program has proved beyond any doubt that education and publicity can bring about a better type of conservation than law enforcement. We are, therefore, encouraged as regards our educational and publicity work and feel that we have been working along the correct lines. The development of a public sentiment favorable to game conservation is just as important, if not more important, than law enforcement.

Chief among the activities of our Bureau of Education, Publicity and Research have been the publication of a quarterly magazine, the display of moving pictures of wild life, and an extensive series of illustrated lectures given to school children, boy scouts and other organizations.

Law Enforcement.

The activities of the commission in the enforcement of law are clearly shown in the number of arrests made and convictions obtained. During the biennial period convictions were had in 707 out of 821 arrests for the violation of fish laws, and 845 convictions out of 976 arrests for violations of the game laws. This makes a total of 1,552 convictions. The fines collected amounted to \$31,639.50. In addition 2,465½ days imprisonment were imposed on violators. The seizures of fish taken illegally amount to 33,124 pounds. Over 11,000 ducks and nearly 3,000 geese were also seized because they were taken illegally; 276 illegal nets were taken from violators. Illegally used fishing apparatus, after condemnation in the Superior Courts, is destroyed or sold in accordance with law. All wholesome fish and game is donated to public and charitable institutions. Searches of markets, private individuals, conveyances, etc., for illegal fish and game amounted to 318.

Propagation of Game Birds.

Following out the policy determined upon several years ago, there has been no concerted effort to rear game birds for distribution. A few pheasants and quail have been reared on the State Game Farm, but activities at the farm have been greatly curtailed. A number of birds have been sold during the biennium, and the remaining stock will be disposed of before the farm is abandoned in November, 1918.

Lion Bounties.

The constant demand for an increase in the bounty on mountain lions paid by the commission, so that remuneration would be sufficient to make lion hunting worth while, led to an increase of the bounty on the scalps of female lions. Beginning July 1, 1917, \$30 has been paid on female lions when the entire skin, with evidence of sex attached, was submitted. In all cases where the sex could not be positively identified only the usual bounty of \$20 was allowed. During 1916 bounties were paid on 179 lions and in 1917 on 188.

Discretionary Powers Needed.

The need of preventing the extermination of some of our most valuable food animals and of conserving our fish and game resources in order to obtain the greatest possible production of food, makes it imperative that a change in the methods of enacting fish and game laws be brought about. At present these laws are enacted for two years and no change can be made during that time. This procedure prevents prompt relief in seasonable emergencies which often arise due to drought, disease, forest fires, etc., and frequently lead to the depletion of streams or the extermination of certain species of animals in the stricken region. If, in addition, hunting and fishing can not be prohibited or curtailed in that section because of clumsy legislative methods, it is clear that extensive damage to the wild life of the afflicted district is almost certain. It is therefore proposed to enact legislation endowing our Fish and Game Commission with discretionary powers, such as have been given to the commissions of Maine, New York, Washington and other states, enabling it to close seasons, reduce bag limits, prohibit certain kinds of fishing apparatus, and in general take such immediate steps as will, in their opinion, afford prompt and effective relief and save from destruction by human hand that part at least of the wild life which has survived the adversity of nature.

Acknowledgments.

Acknowledgments are due to the United States Bureau of Fisheries for co-operative work in salmon culture; to the United State Forest Service which has actively co-operated in the enforcement of the fish and game laws and in the accumulation of data on the life-habits of different species of fish and game; to the University of California and Leland Stanford Junior University, who have undertaken investigations and helped to solve many problems; and to the following railroads of the state who have continued to furnish free transportation of eggs and fish used in stocking the streams: Southern Pacific Company, Western

Pacific Railway Company, Northwestern Pacific Railroad Company, Atchison, Topeka and Santa Fe Railroad Company, Nevada-California-Oregon Railway Company, Lake Tahoe Railway and Transportation Company, Ocean Shore Railroad Company, Sierra Railway Company of California, California Western Railroad and Navigation Company, Amador Central Railroad Company, McCloud River Railroad Company, Yreka Railroad Company, Oakland-Antioch and Eastern Railway, Northern Electric Railway Company, Central California Traction Company, San Joaquin and Eastern Railroad Company, Visalia Electric Railroad Company, Yosemite Valley Railroad Company and Virginia and Truckee Railroad.



REPORT OF ASSISTANT EXECUTIVE OFFICER.

The Honorable Board of Fish and Game Commissioners:

SIRS: The personnel of the employees of the Fish and Game Commission has undergone some change during the past two years. Two capable deputies, R. B. Heacock and Richard Squires, were killed on Bouldin Island in December, 1916, while arresting three Italian fishermen who were fishing illegally in the waters of that island. Alonzo F. Lea died from injuries received at his home in Cloverdale in October of the same year. Deputy Lea in years of service was one of the oldest employees of the commission. He worked chiefly in Mendocino, Lake and Sonoma counties, although when the patrol force included only a few men, he was detailed to various parts of the state. Paul Smith, a deputy who had worked chiefly in Del Norte and Sonoma counties, died from appendicitis in January, 1917. All of these men were thoroughly trained deputies and it has been exceedingly difficult to replace them.

John P. Fisher, in charge of the License Department, died from heart trouble while hunting near Los Banos in November, 1916. Mr. Fisher was a thorough naturalist and made the habits of our game a lifelong study. As a result he was particularly well informed regarding game conditions in our state.

Mrs. Leo N. Pettit died in September, 1917. Mrs. Pettit was one of the most capable employees of the Fish and Game Commission. At the time of her death she was acting as chief clerk, having charge of practically all of the records of the commission. She entered the service of the state as a stenographer and on account of her peculiar fitness and capability she was advanced from time to time and occupied a very responsible position at the time of her death.

The development of the Commercial Fisheries Department has made it necessary to transfer a number of employees to that branch of the commission and also to employ additional help.

On account of the fact that all employees are appointed under the state civil service law, it is necessary in order to discharge an inefficient person, to file charges before the Civil Service Commission or appointing power. As a rule the employee is given an opportunity of resigning

before charges are filed. During the biennial, charges have been filed against seven deputies, six by the Fish and Game Commission and one by a citizen. In four instances, resignations were filed before the date of trial. Three, however, stood trial and were dismissed.

One of the hearings held by the Civil Service Commission was the most bitterly contested in the history of civil service in California. Three sessions were held and on account of the voluminous evidence introduced, the commissioner who acted as judge, requested that briefs be submitted. In the decision every charge filed against the deputy was upheld.

It is sometimes said that civil service handicaps efficiency and that it is impossible to remove an employee after he is once in office. The experience of the Fish and Game Commission refutes any such statement. When an employee is not doing the work he is supposed to do, the civil service law will not hold him in office.

Civil service trials are not particularly pleasant for those who file a complaint, for they are as much on trial as the defendant; but if they have the good of the service at heart, an unpleasant incident of that sort should not hold them back.

New Laws.

At the last session of the legislature, several laws were passed that will have the greatest influence upon future game conditions in our state.

One of the most important of these laws was the change in the Game Districting Act, whereby a number of game refuges upon which there can be no hunting, were created. On these refuges deer and other game animals will be allowed to breed undisturbed. There are now game refuges covering nearly two million acres in the heart of the game country. From these refuges game will spread on to the adjoining land where the general public can reap the benefit. No matter how scarce game may become in other parts of the state, as long as these refuges remain there will be an abundance in the lands adjoining them.

The Trapping License Act was another important law passed during the 1917 session. By this act, protection is given to valuable fur-bearing mammals and the wanton killing of these mammals prohibited during the season of the year when the furs are worthless. The fur industry is one that is well worth conserving and if it can be developed through the protection given by this act, it will bring additional thousands of dollars into the state. The law was very well received by the trappers throughout the state. Between three and four thousand licenses were taken out and approximately one-sixth have reported the

number of furs taken. The amount received for the catch of the trappers would approximate forty thousand dollars. From this it would appear that the catch of furs in this state is worth not less than two hundred and fifty thousand dollars. It is certain that with the protection given the fur-bearers by this law the value of the furs taken in California will be very greatly increased. The law provides that fur-bearing mammals can not be taken by trappers except during the months of November, December, January and February, but provisions are made whereby mammals injuring private property can be killed at any time.

When the postal regulations were changed so as to allow the shipment of game by parcel post, market hunters and dealers were quick to take advantage of the opportunity to ship without having their shipments inspected by our deputies. They realized that the deputies of the Fish and Game Commission did not have the same authority to inspect parcel post as they did express shipments. The San Francisco markets were filled with parcel post birds and it was impossible for deputies of the commission to control the situation. Appeal was made to the federal authorities but very little co-operation was secured. It was on account of this, that the legislature was asked to pass an act prohibiting the shipment of any game by parcel post. The act was passed and went into effect in August, 1917. At this time notice was sent to the postmasters throughout the state through the Postal Inspector in San Francisco. The Postmaster in San Francisco, believing that the act was unconstitutional, took the matter up with the Postal Department in Washington and the department assumed the authority to declare the law unconstitutional, but the Supreme Court in its decision upheld the law. Mention of this case will be found in the report of the attorney for the board.

The law regarding the domestication of wild game was amended and simplified and many of the prohibitive portions of the old law were eliminated. It was thought that by so doing, interest in game rearing could be stimulated. There is, however, at the present time very little interest shown in this state in game rearing, possibly on account of the high prices secured for poultry. Individuals located in portions of the state where game rearing could be carried on to advantage are loath to try the experiment. Without doubt, certain kinds of game can be reared profitably and in sufficient numbers to reimburse the breeder for the expense incurred.

Game Conditions.

California game conditions have not changed greatly during the past biennial period. The laws that have been created by the legislature

at the suggestion of the Fish and Game Commission have protected the existing species of game so well that there are very few parts of the state in which some kind of game can not be found in abundance. Few states have been so abundantly supplied with game as has California. Unfortunately, there are but remnants of elk and antelope that were formerly abundant. These animals were practically exterminated before the importance of game protection was realized. Deer, however, were more able to look after themselves and in spite of the hide hunters there was enough breeding stock when protective laws were passed so that today in many localities deer are as abundant as they ever were. Within a few miles of San Francisco during each open season there are killed over 2,000 deer. Where in this country can such hunting be found near a city of over a half million people? With the continued development of the automobile the wild game resources have been more heavily drawn upon, and it will be necessary, from time to time, to still further protect our game by shortening seasons and reducing bag limits.

No matter how carefully the work of educating the people as to the necessity of observing the game laws may be carried out, there will always be those who willfully or carelessly kill game or take fish out of season and are willing to assume the risk of getting caught. For these individuals a most severe penalty must be provided. It is on this account that many of the game laws carry a penalty ranging from \$25 to \$500. When the judges before whom game cases are tried, impose the heavy fines they have the power to impose, many violations will stop.

Contrary to what some people believe, most of our game laws are based upon sound principles and are intended to give protection to game as well as to provide shooting for the red-blooded man who enjoys field sports. Game is valued from an esthetic point of view, but it is more valuable as a health stimulant and as a means of taking the busy man's mind away from business worries.

There is no problem concerning which there are so many diversified opinions as there is over game protection. There are very few hunters who will have the same idea as to the length of time of an open season and the amount of the bag limit. This difference of opinion comes about from the fact that each hunter is looking at the problem from his own individual point of view and he is familiar with conditions in only a small part of the state. Many are extremely selfish and want long seasons and high bag limits, regardless of the fact that the hunters have increased and facilities for getting into the field have brought distant sections within a few miles of populated centers and at the same time the breeding capacity of the game has not increased, but on the contrary has decreased on account of the fact that more and more

breeding ground is being cultivated and as a result destroyed as breeding ground.

To illustrate the difficulty of game law making, we will refer to the present law protecting valley quail. It has been apparent for some time that quail need additional protection but the best way to do this was not easy to determine. The bag limit could be reduced but a bag limit law is difficult to enforce and it requires considerable time for the hunters to become accustomed to a change in a limit law. There are always a great many unintentional, as well as willful violations on the part of hunters who think they are unfairly treated when a bag limit is reduced.

It has been found that after the Christmas holidays there is much less interest in hunting than during the first few weeks of the open season and that when the season is open in January there are fewer birds killed than in December. It was finally determined that better protection would be given by opening the season one month later and to allow the open season to run until the end of January, thus leaving the season the same length as before, two and one-half months. The hunter thus has the same length of time to go after birds if he so desires, the bag limit remains the same, but, on the other hand, the season opens after the birds are much larger, better developed and more able to take care of themselves and, best of all, they are protected by a law that can be easily enforced.

Deer. The spike buck law that was created by the legislature of 1915 has proved one of the best protective laws that has ever been adopted. With the opening of the 1918 season there should be a large number of big deer taken. The protection of spike bucks has eliminated to a remarkable degree the almost universal complaint of a few years ago that the country was filled with barren does. If there are any barren does, it is on account of the fact that there is a scarcity of bucks. Rather than have a law that would allow the killing of does, we should have a law that would prevent the killing of too many bucks. This has been accomplished by the spike buck law. The spike buck answers all the purposes of the breeding male and there will be few, if any, barren does. Not only does the law better protect deer, but it also prevents the killing of other hunters by those, who, under the stress of excitement, shoot and look afterwards. It requires the hunter to look a little longer before he shoots and to ascertain what may be his target. As a result he will not carry through life the unfortunate regret that he killed a fellow sportsman. Another feature of this law is that it requires a person who kills a deer to retain the head and hide of the animal killed for a limited time in order to prove, if necessary, the

character of the deer killed. This section has prevented the killing of many does and has enabled the deputies, who enforce the law, to bring into the court many violators, who thought their act could not be traced.

Ducks. Duck hunting during the 1916-1917 season was excellent in all parts of the state frequented by ducks. The benefits of the Federal Migratory Bird Law were realized in the bag limits that were secured. Last season, shooting was not up to expectations and on account of the very open, storm-free winter, the bulk of the birds stayed in the Sacramento Valley, there being no water to attract them further south and no storms to force them to more southern locations. In spite of the contrary season there were a great many birds killed.

Just after the duck and goose season closed many complaints were received by the Fish and Game Commission from the vicinity of Tulare Lake, to the effect that geese were destroying the newly sprouted grain. There were many requests from the hunters and a very few from the farmers that the season be extended, so that the fields could be protected. As a matter of fact, geese do very little, if any, damage to growing grain. Where the country is not water soaked, the cropping they do is a decided advantage as it increases the number of stalks in the stool, thereby increasing the yield of grain. Where there is standing water on sprouting grain, damage will be done, but it is a question of whether the most damage is done by the birds or by the water. In all probability, water standing on alkali land will kill the grain quicker than will the puddling of the geese. That no serious damage was done in this section is proved by the following clippings from a Fresno paper:

CORCORAN, July 13.—The Forrest Riley harvesting crews on Monday finished the harvest of 2,100 acres of wheat and 700 acres of barley on the Harvester Ranch, owned by Garfield Jones of Los Angeles.

Approximately 42,000 sacks of wheat and 11,000 sacks of barley, 53,000 sacks in all, have been threshed. At the present market price, the crop grossly is worth \$175,000. The yield as a whole is one of the best ever recorded over a large tract in the Tulare Lake country. It is estimated that Jones' net profit on the grain crop will not be less than \$125,000.

The entire crop of the Harvester Ranch has been purchased by Norcross and Walsh, one of the biggest grain transactions in the history of the Corcoran district.—*Fresno Republican*, July 17, 1918.

CORCORAN, July 13.—What is believed to be the heaviest field of wheat in the lake district this year is being harvested this week by W. F. Turner and C. von Glahn on the Carroll W. Gates' section of El Rico. Harvesting began Tuesday and 245 sacks of mixed wheat and barley were cut from the first eight acres, averaging more than thirty and one-half sacks or about sixty-two bushels.

"I believe the average will hold good throughout the 960 acres," said Turner. "The result is due to initial preparation of the land and irrigation at the right time. I look for not less than 30,000 sacks from the section and a half, worth at present prices, about \$132,000."—*Fresno Republican*, July 14, 1918.

The ranches mentioned above were two which reported most damage by geese.

The question of "ducks vs. rice" is, perhaps, more serious, but the damage that may be done by them is greatly overestimated. It is customary to blame everything on ducks—a wind may shake out the

ripening grain, blackbirds break the stalks, the water supply may fail—no matter what the case, if there is anything wrong with the crops, the blame is placed on the ducks.

Suggestions have been made that the season should open earlier in the Sacramento Valley in order to make it legal to kill ducks in the rice fields previous to the harvest. The rice growers themselves are opposed to allowing hunters in the fields at this time as hunters do more damage than ducks. There would be so many hunters after ducks on the loafing ground where no crops are grown, that the ducks would be driven into the rice fields and instead of relieving the situation, it would be made very much worse.

It has been found that rice fields can be well protected by the use of searchlights and sky bombs, but there are numerous individuals, most of whom have no rice, that insist that the only way to prevent damage is to kill all the ducks.

It is the intention of the Fish and Game Commission and the United States Biological Survey to make a complete investigation during the coming fall and to determine just how much damage is done by the ducks.

Doves. There is much complaint from the section east of the San Joaquin River in District No. 1, on account of the dove season opening on August 1. In that section the doves are not through nesting and the killing of parent birds means the starvation of nestlings. The writer has a picture of young doves in a nest taken at Merced on the third day of September, 1917. It is, perhaps, a rather late nesting record but it is not at all unusual to find birds nesting even later. Certainly the season should be arranged so that young birds should not be left to starve.

In southern California, the dove hunters insist that the season should open not later than August 15. They say that by the first of September the birds have all left. It is interesting that the same complaint is made in the northern part of District No. 1. In the Fresno and Merced sections the birds are still nesting in August. Just where the doves go from southern California and northern California is not explained. Fortunately, the argument in regard to the dove season is settled for a time by the fact that the protection of these valuable birds has been taken over by the federal government, in accordance with the provisions of the Migratory Bird Treaty with the British Government and a blanket season opening September 1 has been fixed.

Quail. It is evident that the later opening of the quail season has been a most excellent measure. The birds are more mature by the fifteenth of November and greater work and skill is necessary if the

bag limit is to be taken. This past spring has been most favorable and quail are reported abundant in nearly all sections of the state. An attempt has been made to estimate the number of quail that are killed during the open season. The ideas of various hunters are so different that anything like an accurate estimate can not be made. Some hunters who are well acquainted in all parts of the state, say that they do not believe fifty thousand birds are taken while others, who are equally well informed, state that fully five hundred thousand birds are killed each season. The commission will attempt to secure more definite information during the coming open season.

Respectfully submitted.

(Signed) J. S. HUNTER,
Assistant Executive Officer.

REPORT OF THE DEPARTMENT OF FISHCULTURE.

The Honorable Board of Fish and Game Commissioners.

GENTLEMEN: We herewith submit a brief report on the operations of the Department of Fishculture for the two years beginning July 1, 1916, and ending June 30, 1918.

TROUT DISTRIBUTION.

These two seasons were very favorable for hatchery operations. The total output of trout fry for the biennial period was 35,058,000, an increase of 16 per cent over the previous two years. The output of trout fry for 1916 was 16,214,000; for 1917 it was 18,844,000. This is the largest number of trout fry distributed during the same period of time in any state of which we have any record. These fish were hatched and the fry shipped to the different streams and lakes of the state. There are records in some other states of an equally large output of trout fry, but the great majority of them were planted locally near the hatcheries.

The fry above mentioned were distributed, to a large extent, by our distribution cars over an area greater than any other state in the Union. Our distribution was carefully made and the fry planted in good condition.

The great number of people traveling through the mountainous districts of California, eager to hunt and fish, has caused all the accessible streams to be fished very heavily. The easy accessibility of the streams in many localities, and the great number of fish taken, has caused such a heavy demand on the streams that the output of fry should be increased to 25,000,000 or 30,000,000 annually. If this is not done, the fishing season should be shortened or the daily or weekly limit reduced. The present limit of 10 pounds a day is excessive, and should be reduced. If the limit of 10 pounds a day is to be allowed, as a great many anglers do not care to go to the expense of a trip to the country for a less amount, then the weekly limit should be reduced. The excessive fishing in the districts near the centers of population and near the highways has caused a great many streams to yield only small fish, the fry not having a chance to attain any considerable size. Fry planted in the summer or fall are caught the next spring, when they are only from 4 to 6 inches in length. This condition could be greatly improved by enacting a law giving the Fish and Game Commission the power to close certain streams for a limited period, thus allowing the fry a chance to grow. If certain streams in each district were closed for

a period of one or two years, and other streams opened to the public for fishing, the people would enjoy angling to a greater extent than they do under present conditions. Thus streams closed for a period long enough to enable the fish to attain a length of from 10 to 12 inches would afford more real pleasure and enjoyment than several streams fished as they are now, particularly in districts easily accessible to the anglers.

During the year 1916, a total of 9,377,000 trout fry were distributed from the Mount Shasta Hatchery, and in 1917 the total was 9,972,000. During the summer and fall of 1918, approximately 8,000,000 trout fry will be distributed in the streams of the state from this station. From 8,000,000 to 10,000,000 trout fry is all that can be successfully reared and distributed from Mount Shasta Hatchery with two fish distributing cars in operation.

If the propagation and distribution of fish is to keep pace with the increasing demand upon the fish resources of the streams and lakes caused by the improved highways and the ever increasing number of automobilists, who take advantage of them to get into the heart of the fishing country, both for extended vacations and for one or two day trips, it will be necessary that more small hatcheries be constructed in locations in the different sections of the state where conditions are favorable for the propagation of fish.

While the production of trout fry from Mount Shasta Hatchery averaged from 4,000,000 to 6,000,000 fish each season, it was a comparatively simple matter to distribute them in the streams within the season from June to November, but since the demand for fish from every section of the state became so great that the output had to be doubled, the problem of arranging a satisfactory system of distribution became a serious one. The distances necessary for our distribution cars to make delivery from Sisson present a different problem than is experienced in any other state in the Union. In taking a shipment of fish from the Mount Shasta Hatchery to San Diego and returning to the station, our crew must travel approximately 1,870 miles—a distance nearly 100 miles greater than that from San Francisco to Omaha, Nebraska.

Experience has demonstrated that an efficient distribution of fish in excess of nine or ten million trout fry can not be made. It, therefore, follows that to keep up with the requirements of the situation, more small hatcheries must be constructed. The distribution of fish from such small stations is generally made to cover a section within a radius that can be covered by using a small auto truck as the means of conveyance. The fish can then be planted by our experienced fish culturists directly in the streams, instead of being shipped in baggage cars to

the nearest railroad station of the applicant, who generally attends to the planting of the fish. It has, therefore, been the aim of this department in the last two years not to increase the output of fish from the Mount Shasta Hatchery. Indeed, during the current season we have reduced the output slightly in the interest of economy of operation and efficiency of distribution. At the present writing, this arrangement promises to be as satisfactory as we had anticipated. Under the new arrangement, the territory covered in the distribution from Mount Shasta Hatchery is that section from Ventura County on the coast north to Sonoma County, and inland from Fresno to the Oregon line, except the local territory therein covered by the distribution from the smaller stations.

The territory composed of what is generally termed "southern California" and the San Joaquin Valley north to Fresno is taken care of by the Mount Whitney Hatchery, supplemented by the distribution from Bear Lake Hatchery in San Bernardino County.

On February 2, 1917, the Mount Whitney Hatchery, located on Oak Creek near the town of Independence, Inyo County, was turned over to the Fish and Game Commission by the Department of Engineering, under whose supervision the hatchery was constructed. The building is a beautiful structure of granite and gabbro, and the coloring of the rubble walls blends harmoniously into the background of giant peaks that form the west wall of the valley. While the hatchery building itself was completed at the time it was turned over to this commission by the Department of Engineering, there still remained a great deal to be done to prepare for piscicultural operations. All of the hatchery equipment and apparatus necessary to handle the eggs that were to be hatched at the station, was made by the employees of the hatchery department. All of the essential equipment was provided for the operations, which commenced with the receipt of steelhead trout eggs from Snow Mountain Station on May 31. Later, shipments of black-spotted trout eggs were received from Tallac Hatchery, and during July rainbow eggs were received from Rae Lakes Station. As a matter of necessity, the first season's output was comparatively small, but the 1,285,000 fish distributed in the waters of southern California, the Lower San Joaquin Valley, Inyo and Mono counties, were an exceptionally fine lot of fish. The ample supply of pure water in Oak Creek, that gushes from the granite rocks of the basal slopes of the Whitney Range, has proven to be excellent for the propagation of trout. The fry advance very rapidly, and are strong and vigorous. The distribution of the fish was very satisfactory in every particular.

Distribution Car No. 01 was taken off the Mount Shasta Hatchery distribution during the latter part of September, and sent to Mount

Whitney Hatchery. Arrangements were made to load the car at Lone Pine, and the two 3-ton auto trucks, which had been especially designed for the purpose, transported the fish from the hatchery across the desert to the car in record time. Favorable railroad connections were made, thus eliminating long delays, and the fish all reached the streams in less time and in better condition than in previous seasons, after the long hard trip from the Mount Shasta Hatchery.

One of the most important plantings of fish during the season was the stocking, by the employees of this department, of the 60 Lakes Basin with steelhead trout fry from Mount Whitney Hatchery. The 60 Lakes Basin is composed of a main chain of lakes supplemented by numerous large lakes, some of which are from 20 to 40 acres in extent, located on benches, and draws that flow into the lower system. The lakes below afford excellent spawning ground, and through most of them the fish can swim from one lake to another for a distance of nearly three miles. Two shipments of fish were taken from the hatchery by pack train and the fry liberated in the main lakes. In all, about 20,000 steelhead trout were planted.

Rainbow Trout.

A reference to the statistical tables for 1916 and 1917 on pages 73 and 77 of this report, shows that rainbow trout, 2,044,000 in 1916 and 3,040,000 in 1917, were distributed from Mount Shasta Hatchery. In 1917, 317,000 trout of this species were distributed from Mount Whitney Hatchery. In 1916 and 1917, 209,000 and 241,000 rainbow were liberated in the streams of the Tahoe region from the Tahoe hatcheries. From Fort Seward Hatchery, 94,000 and 143,000 were planted in Del Norte, Humboldt, Mendocino and Trinity counties. Bear Lake Hatchery furnished 750,000 and 874,000 in the two years for the streams of San Bernardino County. From Almanor Hatchery were liberated 301,000 and 335,000 rainbow fry in Lassen and Plumas counties during the above period, while 126,000 fish of this species were planted in the waters of these counties in 1917 from Domingo Springs Hatchery. Wawona Hatchery, which had not been operated during the three preceding seasons, was reopened in 1917. Eggs of the rainbow and steelhead trout were shipped to the station and the resulting fry, to the number of 147,000 rainbow and 68,000 steelhead were distributed in the streams of Madera and Mariposa counties.

By referring to the reports, it will be noted that in 1916 a total of 3,399,000 rainbow fry were distributed from all the hatcheries. In 1917 this number was increased to 5,223,000. This increase of nearly two million was made possible by our efforts to increase production to keep pace with the demands, through the acquisition of new hatcheries and egg collecting stations.

The Rae Lakes Egg-Collecting Station, located in the Sierras in Fresno County, at an elevation of 10,500 feet, was first operated in the summer of 1917, and produced 365,000 rainbow eggs, which were transported by pack train through the Oak Creek Pass to Mount Whitney Hatchery.

The extensive improvements in the system of operation of the egg-collecting stations at Bogus and Camp creeks on the Klamath River, resulted in an increased production of eggs of the rainbow trout. In the spring of 1917, in excess of three million eggs were taken and were shipped to Mount Shasta Hatchery to be "eyed." The take of eggs during the spring of 1918 was only a little over two million, but this was due to the extreme drought which affected our operations throughout the entire state.

The Almanor Hatchery, which had been established in the spring of 1916 was again operated in 1917 and 1918, and while the number of rainbow eggs secured did not meet with our expectations, the take was sufficient to justify the expense of operation. The failure to obtain the number of eggs which we had anticipated taking was not due to any scarcity of large rainbow trout in the north fork of the Feather River, but was due to the fact that an average of nearly 600 second feet of water was run through the spillway of Lake Almanor by the Great Western Power Company almost continuously during the spawning seasons; the volume of water passing through our fish racks was such that it was impossible for the spawning fish to ascend the streams. In 1918, owing to the extreme drought and the adverse water pressure conditions, only 260,000 eggs were taken.

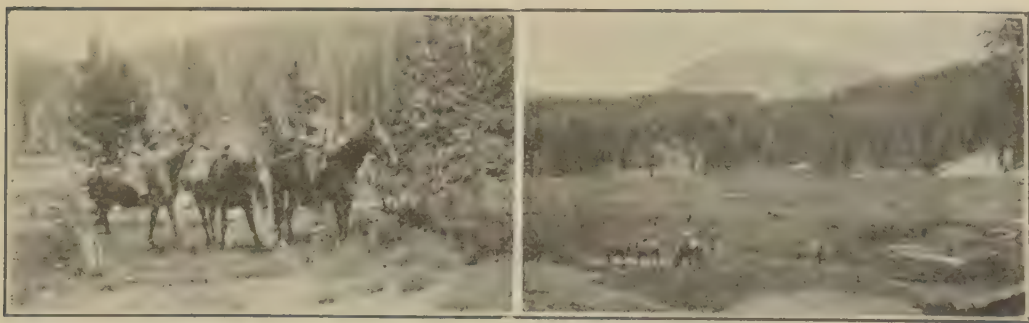


Fig. 2. Planting rainbow trout from the Domingo Springs Hatchery. The fish were transported by horses and were planted in Little Bee Lake, Plumas County, and Kings Creek Meadows, Lassen County. Photographs by H. L. Nehf.

The Domingo Springs Hatchery which was opened for operation in the spring of 1917 promises to be a valuable rainbow egg-collecting station. During the first year, over 800,000 eggs were collected. As noted above, 126,000 were distributed locally, and shipments of "eyed" eggs were made to Mount Shasta and Fort Seward Hatcheries. During

the spring of 1918, despite the extreme drought, 1,250,000 eggs were secured at this station.

During the spring of 1918, following out our plan of increasing the number of small hatcheries throughout the state, an experimental station was established in Plumas County on the line of the Western Pacific Railway on a site selected about a mile from the town of Blairsden on Grey Eagle Creek. Steelhead eggs were shipped to the station from Snow Mountain Station; black-spotted eggs from Tallac Hatchery, and rainbow eggs from Domingo Springs Station; our plan being to thoroughly try out this site in order that we might erect a permanent hatchery thereon should the water prove to be satisfactory for hatchery purposes. From this hatchery all of the trout fry for Plumas, Lassen and Modoc counties along the line of the Western Pacific, and Nevada, California and Oregon Railways could be hatched and distributed. With the inland territory in the Westwood, Lake Almanor and Juniper Lake districts covered by our Almanor and Domingo Springs hatcheries, and all railroad deliveries for the three counties above mentioned taken care of by the Feather River Hatchery, as the plant near Blairsden was to be named, we could have eliminated all long hauls to this section from the Mount Shasta Hatchery. Unfortunately, the water of Grey Eagle Creek did not prove satisfactory for hatchery purposes, and it will, therefore, be necessary that we locate a hatchery in this section on some other creek.



Fig. 3. Big Bear Lake, San Bernardino County, California, which furnishes the best trout fishing to be found in southern California. The Bear Valley Hatchery keeps this lake well stocked with fish. Photograph by Guy Barry, September 15, 1916.

Bear Lake Hatchery was operated in 1916 and 1917, producing 750,000 and 874,000 rainbow trout fry, respectively, for distribution in Big Bear Lake and streams of San Bernardino County. The equipment for extensive egg-collecting operations at this station was inadequate, and we, therefore, decided that it was essential to make a number of improvements. Before undertaking this work, the writer made a personal investigation and complete survey of the entire Bear Lake situation. Following is the complete report of findings:

"On May 28, we proceeded to Bear Lake to investigate the cause of a large run of fish in North Creek.

"On arrival, we found that the lake had risen about seven feet since last season, and that the advancing littoral or shore-line had covered the spawning beds at the mouths of the four small streams that enter the lake. The area of spawning ground on these creeks is very limited. The lake is 8 miles long and from a mile to a mile and a half in width. Its greatest depth is 80 feet at the dam. From this point for a distance of two miles, the depth is about 60 feet. Then it gradually grows more shallow toward the head of the lake.

"The lake is fed by the rain and snow that falls on its watershed. The watershed is small, as the crest of the surrounding mountains will not average five miles distant from the lake shore. During the spring and early summer, the lake is fed by these four small streams, the largest of which is North Creek. It is a rocky stream, flowing through a narrow canyon in its upper reaches, and is about two and one-half miles in length. The mouth of the stream at present is about one-half mile farther up the creek-bed than it was last season, due to the advancing shore-line caused by the filling of the lake. From the present mouth of North Creek, the shore line of the lake in 1915 is about one-half mile distant. This area was in former years the principal spawning ground for the trout in this creek. Above the present shore-line the canyon narrows and is filled with large boulders; it is not suitable for spawning beds. The other creeks present a similar condition.

"This short stretch below the rocky formation constitutes the base of the surrounding hills, and is composed of glacial sand and gravel. The glacial moraine extended to the present boundaries of the lake, and this formation made excellent spawning grounds which are now covered by the lake to such a depth that fish will not spawn there at present.

"From the shore-line of 1915 to the present mouth of North Creek, the stream formerly flowed between two low ridges, the distance between them widening as the lake was approached. The water from the lake now fills this gap, forming an arm or bay that is about 150 yards wide at its mouth and extends for one-half mile up the creek.

"North Creek on May 28, 1917, had about five second-feet of water flowing into this bay, and as this bay is opposite the deepest water of the lake where the large fish congregate during the winter months, and as the mouths of all the other creeks are, or have been obstructed by sandbars, as a result nearly all the spawning fish in the lake entered this bay and attempted to ascend North Creek to spawn. There were a few at or near the mouths of the other streams, but these being obstructed and North Creek being open and accessible through this bay just described, it attracted a great majority of the spawning fish in the lake this season.

"Our attention was called to this phenomenal run of fish on May 16, by Mr. L. Phillips, foreman in charge of our station, who gave an interesting report on the number of fish in this bay. On my arrival, May 28, I estimated that there were between 5,000 and 6,000 adult fish in the bay off the mouth of North Creek. These were principally males that had not gotten over their inclination to spawn. The males are sexually active long after the females are through spawning and have returned to the deep water to recuperate.

"Judging from the number of males and their emaciated condition, the run was practically over and these were the last. They represented about one-third of the male fish that entered this bay, as that is approximately the proportion that lingers around the breeding ground at the end of a run. Assuming this to be correct, there were at least 15,000 males in this bay during the spawning period; and as the sexes are equally divided it means that 30,000 spawning fish came into this bay in an attempt to ascend North Creek to spawn. As North Creek is the only creek of any consequence which the fish could enter, it is not surprising that most of the fish in the lake gathered in the bay into which it empties this spring.

"In the Spring of 1915 the commission operated a trap at the mouth of North Creek, before this bay was formed, and only procured about 360,000 eggs. In 1916 the lake was filling and the mouths of the creeks were changing. That season, approximately one million eggs were collected. Owing to the changed condition of the lake and the great depth of water over the old spawning beds, if proper equipment had been on hand and preparations made, from six to eight million eggs could have been taken in North Creek this season. The take was a little over one million, as that was all we were able to handle with our present equipment.

"As long as the water remains at the present level during the Spring months, or does not recede over five or six feet, North Creek will continue to be the only creek that the spawning fish will enter, excepting Metcalf Creek, which could be improved by opening the mouth, and blasting a fishway over a ledge of rock about one-fourth mile from the present shore line. This would add about one-half mile more of

spawning ground, which offers very good gravel, and the best spawning conditions of any of the creeks. This stream is small, and can not furnish fry enough to stock the lake.

"The ever-increasing number of anglers would warrant the commission in heavily stocking Bear Lake in an ever-increasing ratio, as the drains of the past three years have been enormous, and a great investment is being made this year which indicates even greater demands will be made upon its fish-rearing capacity henceforth. The egg-collecting station should be improved and a new and larger hatchery erected at Green Spot Springs, as that is the only suitable water for hatchery purposes anywhere near the lake. To do this, it will be necessary to have an egg-collecting station containing 40 troughs with a retaining tank at North Creek; as well as a 40-trough hatchery at the springs, if these fish are to be handled and their eggs secured.

"These improvements, comprising a new 40-trough hatchery at Green Spot Springs, with a new flume, etc., and the same sized building for an egg-collecting station on North Creek with retaining tank for holding the spawners will cost approximately \$2,800. This equipment would handle from six to eight million eggs up to the eyed stage. One million eggs should be hatched for the lake; one million for other southern California waters; the remainder of the eyed eggs could be shipped to other stations. About one and a half acres of land, together with the water-right to North Creek, must be leased for 15 to 20 years from the North Estate with privilege of purchase as soon as the said estate is settled, upon which tract the egg-taking station is to be established. As for the hatchery site proper, public sentiment in San Bernardino County so strongly favors increasing our fishcultural work that an arrangement satisfactory to all concerned can be made.

"The improvement of natural spawning conditions on Metcalf Creek is to consist of a log raceway, and a four-pool fishway blasted in the rock forming the main obstruction which now prevents the spawning fish reaching one-half mile of first-class spawning ground above. The cost of this work depends on the distance logs will have to be hauled and the amount of work necessary to get them to the creek; but the work if handled by some practical man will cost approximately \$250. The fishway could be built for \$50. All these figures on the improvements at North Creek, the new hatchery building at Green Spot Springs and the improvement at the mouth of Metcalf Creek are rough estimates, subject to change when the final estimates are made. The ever-increasing cost of materials makes it difficult to estimate in advance the cost of any large piece of work. If the Board of Fish and Game Commissioners approves of these plans, we will proceed to Bear Valley in the near future, make the final plans, and place the order for the lumber, which should be cut and stacked not later than the first of August. There is only one sawmill in the valley and there is considerable building activity around the lake, so the order for the lumber should be placed at an early date, as past experience has demonstrated that delays are expensive."

After carefully considering the matter, it was decided to put up a 30-trough hatchery at the North Creek Station, together with flumes, racks, traps, retaining tank, etc., necessary to properly handle the egg-collecting work. As we were unable to obtain a satisfactory lease to the property on which it was decided to locate the station, it was not deemed advisable to construct a permanent hatchery building. Accordingly, the 30-trough hatchery equipment was put under a large tent 32 x 55 feet. This work was all completed during the fall and winter of 1917. The station was opened in February, 1918, and egg-collecting operations were very successful, 3,500,000 rainbow eggs being taken. Over 1,000,000 eggs were hatched at the North Creek and Bear Lake stations, and the balance were shipped to Mount Shasta, Mount Whitney and Tahoe hatcheries.

Black-Spotted Trout.

Average takes of black-spotted trout eggs were secured at the Tallac Hatchery during the biennial period, 4,100,000 in 1916 and 4,250,000 in 1917 being obtained. After being "eyed" they were shipped to the different stations to be distributed in those sections of the state suitable for this variety. From Mount Shasta Hatchery were distributed through the state generally 938,000 in 1916 and 874,000 in 1917; 2,765,000 in 1916 and 2,709,000 in 1917 were planted in the streams

tributary to Lake Tahoe and other waters of El Dorado, Placer and Sierra counties from Tahoe and Tallac stations. In 1916, the streams of Humboldt County received 132,000 black-spotted fry from the Fort Seward Hatchery.

Mount Whitney Hatchery received a quarter of a million black-spotted eggs from Tallac, which were given a wide distribution in the streams of the high Sierra section of the San Joaquin Valley and Inyo County in the summer of 1917.

During the spring of 1918, approximately 3,000,000 black-spotted eggs were taken at Tallac Hatchery, and after "eyeing," these were distributed to the different hatcheries as in previous seasons.

Steelhead Trout.

The seasons of 1916 and 1917 were banner years for the production of steelhead trout, 5,213,000 and 6,699,000 fry being planted in the streams and lakes of the state during the biennial period.

In an endeavor to ascertain the value of the steelhead trout in inland waters, it was decided in 1915 to experiment with them by stocking some land-locked barren lake in the high Sierras. After a careful investigation, Juniper Lake in Lassen County was selected. Juniper Lake is located on the Lassen-Plumas County line, southeast of Mount Lassen, on a high plateau, at an elevation of 6,000 feet. The lake is deep and beautiful with sloping shores and sandy beaches, and is nearly two miles long, by a mile and a quarter wide, with an abundance of aquatic insects, and being barren of all fish life, it offered a most excellent site for the experiment. On October 15, 1915, a shipment of 25,000 steelhead trout fry was made from the Mount Shasta Hatchery in charge of a special messenger, who planted them in the lake on the following day. Despite the fact that the transportation of the fish was made under difficulties by railroad to Red Bluff, by auto truck from that point to Crescent Mills, and thence by pack train to the lake, the fish were planted in excellent condition. On July 21, 1916, eleven trout were caught from Juniper Lake, weighing about ten pounds. The largest of the fish weighed one and a quarter pounds. Since that date, considerable numbers of steelhead trout, averaging from two to four pounds, have been caught by anglers visiting the lake. It has been demonstrated, therefore, that the steelhead will thrive in the inland waters of the state, and the commission is desirous that they be planted in ever increasing numbers to supplement plants of rainbow, Eastern brook, Loch Leven and black-spotted trout fry. By the addition of steelhead trout to the planting of the other varieties, the streams and lakes of the mountain districts will receive an additional variety of food and game fish, equal as to fighting qualities to any fish that swims.

The steelhead egg-collecting stations were operated to their full capacity both years. Snow Mountain Station produced 4,500,000 eggs in 1916 and 6,000,000 in 1917. The increased number of eggs taken in 1917 was due to very favorable egg-collecting conditions, and to the fact that facilities had been greatly improved for handling the fish and "eyeing" the eggs. Nearly all of the eggs were shipped to other stations to be hatched and distributed. Steelhead fry to the number of 184,000 and 202,000 were distributed locally in the streams tributary to the Eel and Russian rivers during the two years.

The take of eggs in 1918 amounted to only 3,250,000. This small take of eggs was due, as at other stations, to the drought, but at this station conditions were much more serious than in other sections of the state. Not only did but very few spawning fish get up as far as the dam, where our station is located, but during the latter part of April, the water became so warm that the fish in the traps, which were being held for spawning purposes, could not survive, thus necessitating the closing of the station a month earlier than usual.

Scott Creek Egg-collecting Station was operated as in previous years, and the 2,000,000 and 2,250,000 eggs taken in 1916 and 1917 were shipped to Brookdale for "eyeing." A portion of the eggs were shipped to other stations and the balance hatched and reared for distribution in Santa Clara and Santa Cruz counties. The total number planted in these two counties amounted to 881,000 in 1916 and 985,000 in 1917. At Scott Creek Station 1,900,000 steelhead eggs were taken in the spring of 1918.

Of the steelhead trout eggs shipped to other stations in the two years from Snow Mountain Station and Brookdale, 2,733,000 and 2,972,000 were distributed by the distribution cars from Mount Shasta Hatchery; 490,000 and 445,000 from Ukiah in the streams of Mendocino and Sonoma counties; and 924,000 and 1,312,000 from Fort Seward Hatchery in the streams of Humboldt, Mendocino and Trinity counties. An additional 715,000 steelhead were distributed from Mount Whitney Hatchery in the waters of southern California in 1917.

During the spring of 1918 most of the eggs taken at Snow Mountain were transported "green" to Ukiah Hatchery to be "eyed" instead of being put into the troughs at Snow Mountain until ready for shipment. Facilities are better at Ukiah than at Snow Mountain for "eyeing" the eggs, and the only impediment to the "eyeing" of the eggs at the former station in previous years was the lack of suitable transportation -Ukiah being at a considerable distance from Snow Mountain Station. However, during 1916 we experimented with a small lot of eggs by taking them by stage to Ukiah. As the results seemed favorable, several lots of eggs were "eyed" at Ukiah Hatchery

during 1917, and the results obtained were entirely satisfactory. It having been demonstrated that the long trip between the stations would not be injurious to the eggs, it only remained to make some arrangement for having a conveyance to leave with the eggs immediately after spawning operations had been completed, as delays in transporting them would be dangerous. This difficulty was solved by transferring Ford auto truck No. 3 to Snow Mountain and using it for the purpose. We, therefore, did most of the "eyeing" at Ukiah this season. The water is excellent and facilities better for handling the eggs, and the results obtained under the new arrangements are much better than when the eggs were all "eyed" at Snow Mountain.

The operation of Fort Seward Hatchery during the past two years has been carried out, as originally planned at the time the station was built. Rainbow and steelhead trout eggs have been shipped to the station each spring, and the resulting fry have been given a wide distribution in the streams of Humboldt County, the western part of Trinity County, and a portion of Mendocino County. One shipment of fish was also made to Del Norte County in 1917. The stocking of tributaries of the Eel River has been given particular attention; a large portion of the 2,500,000 fry distributed from the hatchery during the two years being planted therein.

Eastern Brook Trout.

The Marlette-Carson Hatchery was operated during the seasons of 1916 and 1917. In 1916, 55,000 Eastern brook trout fry were planted in Marlette Lake. In addition to this number, 50,000 eggs were shipped to Tallac Hatchery and the resulting fry distributed in the Tahoe region; 527,000 Eastern brook eggs were also shipped to Mount Shasta Hatchery, and the fry distributed in waters throughout the state. In 1917 the Marlette-Carson Hatchery was operated by this commission under agreement with the Nevada Fish Commission, providing that one-half of the eggs taken were to be turned over to the state of Nevada. Our share of the eggs amounted to 200,000, and this number was shipped to Mount Shasta Hatchery.

Eastern brook trout fry were distributed from Mount Shasta Hatchery to the number of 1,963,000 in 1916, and 1,617,000 in 1917. In 1916 the pond fish at the Mount Shasta Hatchery produced 1,500,000. One hundred thousand eggs were obtained from the New Jersey Fish and Game Commission in exchange for a like number of Loch Leven trout eggs, and 527,000 eggs came from the Marlette-Carson Hatchery. In 1917, 1,450,000 eggs of this species were taken from the pond fish, 200,000 were received from Marlette-Carson Hatchery, and 200,000 were purchased in Colorado.

In 1918, 1,250,000 Eastern brook fry will be distributed from Mount Shasta Hatchery. All of these fry resulted from eggs taken from our stock of brook fish.

Loch Leven Trout.

The Loch Leven trout held at the Mount Shasta Hatchery ponds produced 1,468,000 fry in 1916; 1,620,000 fry in 1917; and 1,800,000 fry in 1918. All of the Loch Leven trout fry are planted in waters of the state suitable for this variety of fish.

German Brown Trout.

One hundred thousand German brown trout eggs were received from the Minnesota Fish Commission in the spring of 1916 in exchange for a like number of steelhead trout eggs. A portion of the resulting fry were planted in the Yosemite Valley, and in lakes in Sierra County, and the balance retained in Mount Shasta Hatchery ponds.

Golden Trout.

During the summer of 1917, preliminary surveys were made of the Cottonwood Lakes country, Inyo County, to ascertain whether it would be feasible to undertake the propagation of golden trout.

The Cottonwood Lakes are situated in a rugged, almost inaccessible section of Inyo County near the Tulare County line, at the head of Cottonwood Creek. The lakes were stocked in the early seventies with golden trout from Mulkey Creek, a tributary of south fork of Kern River, and are now teeming with this most beautiful and gamey fish. We found that a number of creeks flowing into the lakes furnish excellent spawning grounds, and on what appeared to be the most favorable locations it was decided to put in racks and trap the fish as they ascend the streams to spawn. On account of the great depth of the snow in this region, the poor trails, and great distance from wagon and railroads, and towns, the proposition presented great difficulties. Nevertheless, we decided to make every attempt to operate. It was ascertained that the fish spawned almost immediately after the ice commenced to break up during the latter part of June. Accordingly, all arrangements were made to be on the ground at the proper time. All of the lumber, tools, tents, camp equipment and supplies, had to be transported overland from Lone Pine by pack train. However, this was all successfully accomplished, and our men reached the site of the station in ample time to catch the first of the fish ascending the streams to spawn. Five hundred thousand eggs were taken and were successfully transported by pack animal from the spawning station to Mount Whitney Hatchery, where they were "eyed." The resulting fry will be distributed in waters of that section.

Shad.

As stated in our last biennial report, the propagation of shad was undertaken during the spring of 1916, an egg-collecting station being established at Yuba City. Fishing began on June 3, and continued until about the middle of July. A total of 872,000 shad fry were planted in the Feather River as a result of the season's operations.

SALMON DISTRIBUTION.

The total output of salmon fry for the last biennial period from the California hatcheries was 25,701,000. This is several million fry less than the average hatch of former years.

Since improving our pond system for rearing of salmon fry, we have arranged with the Bureau of Fisheries for a smaller number of eggs to be shipped to our Mount Shasta Station. It is considered that better results are obtained from hatching and rearing a less number of fry if they are held in the rearing ponds until the following fall than to release a larger number during the winter and spring, after they are hatched. The success of our pond work is very gratifying. Ever since the season of 1914 the pond system of rearing salmon fry at our Mount Shasta Station has been a success in every particular. While fairly good results were obtained previously in rearing salmon in ponds, nothing to equal the work of the last few years was attained. The fry are placed in the ponds during March and April and are held and fed until the first rains in the fall cause the temperature to drop in the creeks and rivers and the water to get in the proper condition for the migration of the salmon fry. They are then from three to four and one-half inches in length and in perfect condition. The large ponds at Mount Shasta Station, with the abundance of good water, are ideal for salmon culture.

We received from the Bureau of Fisheries 18,383,000 salmon eggs in 1915 and 6,853,000 in 1916. The drought that prevailed over the entire watershed of the Sacramento River and over the greater portion of the state during 1916, caused the salmon to spawn on the ripples or shallows in the main river and consequently the take of eggs at the Bureau of Fisheries' stations was greatly reduced.

During the fall of 1917 we received from the Bureau of Fisheries 13,000,000 quinnat salmon eggs. Ten million were planted in the upper reaches of the Sacramento and Klamath rivers and 3,000,000 of the choicest fry were retained in the three large salmon rearing ponds and will be ready for distribution this fall.

Eel River Salmon Station.

It was decided to collect the eggs of the chinook salmon in Eel River during the fall of 1917. Accordingly, arrangements were made to

place a rack across the Eel River at Bryan's Rest. The rack and trap, as well as arrangements to seine the river below the racks, were completed in due time, but owing to the heavy fishing by the market fishermen in the lower reaches of the river, our efforts did not amount to much.

The Eel River is a stream that has its source in the middle range of the Coast Mountains. It has a greater fluctuation from the maximum to the minimum flow than any other river in California. The formation of the mountain ranges are sedimentary to a great extent and the rocks and soil are loose and friable. While it is a region of heavy rainfall, the character of the soil and rock formation is such that it does not hold up the water and the variations of the flow of water in the tributaries and main river are very great. At Scotia, about 25 miles from the mouth and above the confluence of the Van Duzen River, gauging has shown the maximum flow in January to be 111,000 second-feet and minimum flow in September 104 second-feet. This was in 1913, a year of normal rainfall. From the mouth of the south fork of the Eel to the mouth of the main river, a distance of about 35 miles, the bed of the river is very wide, averaging in many places, a half mile. The bed is composed of loose gravel and sand through which the water runs very freely during the low water stage. From Scotia to the mouth are a series of large pools with a stream of shallow water running from pool to pool until it reaches its outlet in the ocean south of Humboldt Bay.

During the summer large numbers of salmon enter the pools in the lower reaches of the river from its mouth, a distance of ten to fifteen miles. They can not ascend farther up the river, as the water is too shallow. Above the mouth of the south fork of the Eel River the water is spread out over the ripples to such an extent that the salmon and steelhead do not ascend the river above this point until the rains in the fall. If there are rains during September and October heavy enough to raise the river so that the salmon can ascend, the breeding fish reach the spawning ground on the upper reaches of the river, but in seasons of drought, such as the season of 1917, the river did not raise to any appreciable extent until November 5, when there was a raise of about one foot on the ripples above the racks at the egg-collecting station, but it did not last long enough for the spawning fish to ascend from the pools on the lower reaches of the river. On November 30, there was a raise of about three feet and our racks were damaged so that they were ordered removed. It was then too late to expect sufficient fish to ascend the river to justify the expense of repairing the damage, as the market fishermen had the opportunity during the low water period to catch so many of the fish that very few were left to

ascend the river. The present open season for salmon, from October 7 to December 8, for market fishing on the Eel River is a well-timed season under normal conditions when there are rains during September, October and November, particularly during October, so that a fair portion, at least one-third of the run can ascend the streams to spawn. During the fall of 1917 very few salmon ascended the river after December 1.

Close inquiry regarding the salmon run on the upper reaches of the river and the different tributaries, resulted in the statements that salmon were very scarce, and in some tributaries very few, if any, were seen. There is one interesting fact in regard to keeping up the supply of salmon in Eel River, and that is it requires less fry to keep up the run than any other stream of which we have knowledge, as the enemies of the young salmon are less than in any other stream in the state. There are no predatory fishes except the young steelhead trout, and they seldom feed on salmon fry in the Eel River. There are no overflows where the young salmon can perish and there are no irrigating canals to divert the water. We hatched and reared approximately 1,000,000 salmon fry from the eggs that we collected at our egg-collecting station at Bryan's and from other eggs shipped to the Fort Seward Hatchery from the Sacramento River stations. These fry were held until they were in good condition and planted near Fort Seward Hatchery in the creek and in the main river. There is only one remedy for such conditions as prevailed on Eel River last season, and that is to give to the Fish and Game Commission plenary power to open and close the season if abnormal conditions prevail. The board should have the power to close the season earlier if such conditions exist that the fish are being caught in such numbers as to endanger the run of spawning fish, or to open the season earlier during the periods of drought and low water, so that the fish can be taken at a time when they are in good condition and a sufficient number of them left in the stream for propagation.

The following is a brief report from Mr. W. O. Fassett, Superintendent of Fort Seward Hatchery, regarding the egg-collecting operations at Bryan's during the fall of 1917:

"On October 10, upon orders received from Mr. W. H. Shebley, in charge of fishculture, we started work putting in racks across Eel River, at Bryan's, with the object of collecting chinook salmon eggs. The racks were completed and everything in readiness for operation October 26.

"Several weeks prior to October 7, the date when the open season for salmon commences on Eel River, the salmon were entering the river and congregating in that part of the river below Fernbridge, the river being too low to allow them to proceed farther. By October 7, the opening day of the salmon season, vast numbers of salmon were congregated in

this stretch of water. In this same place 150 to 200 nets were in operation during the season. On November 5 the river raised about one foot, being the first opportunity the fish had to proceed up river since the season opened. Up to this time no salmon had made their appearance at the racks, and it had allowed almost one month's netting in an area from which it was absolutely impossible for any fish to escape. On November 30 high water washed out the racks and further operations were discontinued. Up to this time we caught 38 males and 71 females, a total of 109 fish, with a result of 253,000 eggs."

During the same period the market fishermen shipped from this county 685,674 pounds of chinook salmon, which reduced to fish allowing 20 pounds to the fish would make 34,283 salmon caught from October 7 to November 30.

Summary.

Salmon caught at racks, October and November.....	109
Salmon caught by market fishermen from same period, exclusive of local consumption	34,283

Klamath River Salmon Station.

In January, 1913, the California and Oregon Power Company began the construction of a concrete dam in the Klamath River two and a half miles above the mouth of Fall Creek in Siskiyou County. This dam, 110 feet high, has required a great deal of study on the part of this department. The great problem involved was whether an efficient fishway could be constructed on such a dam, and if such a fishway was constructed, what would be the benefit derived from such an undertaking. The principal run of fish on the Klamath River in the region of Copco dam is trout and salmon. The Federal Bureau of Fisheries has operated a salmon egg-collecting station on the river below the dam and have for the last eight years prevented the salmon from ascending the river above the racks at Hornbrook. This is necessary that the supply of salmon may be maintained in the Klamath River. If the racks were removed and the salmon allowed to ascend the river and a fishway constructed that would allow the passage of the breeding salmon above the dam, the resulting fry would have to return to the ocean and on their downward journey would be destroyed by the power wheels of the hydro-electric plant that takes the water from the dam, for in our opinion it is impossible to successfully screen a pipe that has such a suction as the tubes that feed the turbines at this plant. Therefore, in our judgment it would be a waste of time to construct a fishway for the passage of salmon above the Copco dam.

The trout in the Klamath River are distributed locally, as well as by a run of sea-run fish. The great majority of the trout that are in the upper regions of the river are fish that inhabit the local pools. These

fish can be increased and improved by the establishing of a hatchery on the Klamath River below the Copco dam where several hundred thousand fry can be hatched each season and planted in the upper reaches of the river above the dam. In the large body of water formed by the Copco dam the trout will thrive and furnish excellent fishing on all the upper reaches of the river.

Under the provisions of the law passed by the last legislature, whenever a dam or other obstruction is placed in a river or stream that, in the judgment of the Fish and Game Commission, is too high for the successful operation of a fishway, or for other reasons it is deemed best to establish a hatchery below the dam for the propagation of any species of fish that may be interfered with by the construction of the dam, the owners of the dam must construct and equip a hatchery for the purpose of propagating fish for the river and turn it over to the state for operation. This is the policy that the Federal Government is taking in Alaska, and it is the law in the State of Washington. Last year five hatcheries were built and equipped in Washington by the owners of large dams and turned over to the state. Our commission is trying to follow the same course on the Klamath River, as it is the only practical way of insuring a good supply of trout in the upper reaches of the Klamath River.

The trout fry will not to any extent descend the river or pass through the tubes furnishing water to the power plant, as it is well known that the young of the trout do not inhabit the deeper water of any lake or pool, but prefer the shallow water and the current that they continually head against up stream.

The salmon fry, on the other hand, on their migration to the sea move slowly backward with the current and are easily drawn in to any pipe or over the crest of a dam or waterfall, while the instincts of the trout fry cause them to avoid all such places.

All arrangements are now complete for the construction of a large, modern hatchery on Fall Creek this summer. This hatchery will be used to propagate salmon as well as supply the upper reaches of the Klamath River with an ample number of trout fry to insure as good, if not better, fishing in that section than was had before the dam was built. The California and Oregon Power Company, complying with the provisions of the law, will establish this hatchery free of all expense to the state, turning it over to the commission for operation.

The racks and traps will be located at Klamathon, where successful egg-collecting operations have been carried on by the California Fish and Game Commission and the United States Bureau of Fisheries for several years past, and the hatchery on Fall Creek, 12 miles from the

racks. When it was decided to have the California and Oregon Power Company establish a hatchery in lieu of a fishway, the matter was taken up with the Bureau of Fisheries at Washington, D. C., with the object of having the California Fish and Game Commission and the Bureau of Fisheries co-operate in the work of running the station. The bureau declined the offer and kindly relinquished all their interests on the river so that the California Fish and Game Commission could have sole management of the operations. The new hatchery on Fall Creek, the cottages for the attendants, and racks and traps at Klamathon, and the equipment necessary to operate this station, will cost the California and Oregon Power Company approximately \$20,000.

HATCHERY CONDITIONS.

In closing this report of fishculture operations, I am desirous of calling to the attention of your Honorable Board the conditions obtaining at each hatchery and egg-collecting station with reference to the continuance of operations during the coming two years.

Mount Shasta Hatchery. This station is thoroughly equipped to carry out operations in accordance with our general plans. From time to time, it will be necessary to make the ordinary repairs to buildings, ponds, etc., to keep the plant from deteriorating. Arrangements for repainting the five hatchery buildings not later than the summer of 1919 should be made. This will probably cost in the neighborhood of \$1,500. Aside from this, no further repairs nor improvements are necessary. With the purchase of the 1½-ton auto truck, the hatchery is well equipped to handle the transportation of the fish from the hatchery to the fish distribution cars as well as to distribute fish from the hatchery directly into the local streams.

Klamath River Stations. Bogus Creek Station is in first-class condition, with the exception that new traps and holding tanks must be installed, as the old ones now in use are commencing to go to pieces. This work will not cost a great deal.

Camp Creek Station also requires a new holding tank and new traps.

Mount Whitney Hatchery. This hatchery is thoroughly equipped for all fishcultural operations. The two 3-ton auto trucks are in excellent shape, having been recently overhauled by one of our men. With these trucks to take care of the long haul of fish to the railroad station at Lone Pine, and the Ford truck for light hauling, the station is well equipped with transportation. The repair shop was recently fitted with a new drill press and other much needed tools, and all blacksmithing and machine repairs can now be handled right at the hatchery. Telephones, electric light, power for running the meat grinding machine,

etc., have recently been arranged for. The superintendent's and commissioner's quarters have been well furnished, although a few articles of furniture still remain to be purchased. Work on the construction of the large pond and improvement of the grounds around the hatchery still continues, and while much has been accomplished, there yet remains considerable to be done. Great difficulty in obtaining labor and teams has been experienced, owing to the scarcity of labor on account of war conditions. The work is very heavy and slow, but continued progress is being made, and when completed the grounds will be very attractive. The commission is greatly indebted to Mr. John McLaren, superintendent of Golden Gate Park, San Francisco. Not only is Mr. McLaren giving us the benefit of his skill and experience in laying out the grounds and obtaining a competent landscape gardener to direct the improvement work, but he has donated all of the trees and shrubs used in beautifying the grounds.

Rae Lakes Station. Rae Lakes Egg-collecting Station was operated during the season of 1917, but owing to the plans to operate the Cottonwood Lakes Station and the scarcity of skilled help in the spring of 1918 the station was not reopened as we did not have help enough to operate the two stations. No repairs or improvements are necessary.

Cottonwood Lakes Station. The equipment for operating this station is very crude and incomplete, and if the collection of golden trout eggs is to continue it will be necessary that we construct a building for the storage of equipment, egg-collecting apparatus, etc., during the season of the year when the station is not in operation. Proper equipment for egg-collecting operations must also be provided.

Fort Seward Hatchery. When ready for fishcultural operations in February, 1916, Fort Seward Hatchery was far from being properly equipped for regular work. During the fall of 1916 the finishing work was commenced. The superintendent's residence was finished and painted, a fence put up, the hatchery building painted inside and out, a permanent dam constructed in Powers Creek to divert the water into the flume supplying the hatchery, a 12-ton capacity ice house put up to hold enough ice right at the station for shipping all of the fish as well as for the use in keeping the fish food fresh; and a septic tank was installed. The hatchery is now in first-class shape, and the only recommendations which we have to make in connection with improvements is that the road from the hatchery to the town of Fort Seward, which is now practically impassable, be put in first-class shape, and that a permanent cement dam be erected in Fort Seward Creek to divert our main supply of water for the hatchery. We have transferred Ford Truck No. 3 to this hatchery, and, if the road is repaired, it will be possible to distribute a great many fish to much better advantage in the

streams to the north of the hatchery than we are now able to do by shipping them on the trains. We are now endeavoring to get estimates of the cost of the work, which will later be submitted to your board.

Eel River Station. Eel River Salmon Egg-collecting Station will be operated during the coming season. We have practically all of the equipment necessary for egg-collecting work, and but very few materials will have to be purchased this season.

Tallac Hatchery. Extensive improvements in the water supply system at Tallac Hatchery have been made, which will permit us to obtain far better results from this station. Heretofore it has been necessary to complete operations at Tallac by July 1 each season, on account of the high temperature and impurity of the water after this date, but with the new water supply system, we will be enabled to hold the fish throughout the summer months, permitting us to give the fish a wider distribution. The fish will also be further advanced at the time of planting, and this should produce much better results than if the fry were planted so very young. We were enabled to make the improvements in the water supply system through the courtesy of Mrs. Anita Baldwin, who very kindly granted us permission to tap the pipe between Fallen Leaf Lake and the Tallac power plant, and to divert therefrom 50 inches of water. On October 1, 1917, our lease to the Tallac property expired, but we secured a new lease from Mrs. Baldwin running for ten years.

Tahoe Hatchery. With the acquisition of the Walker property near Tahoe City for a hatchery site, the commission has obtained the most favorable location for fishcultural operations in that vicinity. This property, which was procured by purchase at a price of \$2,000, includes, with the three acres on which the hatchery is to be located, three springs which will give us a minimum of 30 inches of water during the driest season of the year. It is planned to construct an attractive and substantial stone building with a capacity of 50 hatchery troughs, and equipped with the most approved modern fishcultural appliances. A new Ford auto truck has been purchased for the Tahoe and Tallac hatcheries for the purpose of distributing the trout fry.

Bear Lake Hatchery. The Bear Lake Hatchery is too small for proper work under the new plan of operations. A larger and more modern hatchery should be constructed and fitted up with proper equipment for carrying on the work in that section. This matter should receive the attention of the commission during the coming season, if possible.

North Creek Station. As stated in the report of fishcultural operations, the construction of a new plant at North Creek has greatly increased our facilities for egg-collecting operations, and the first year's

experience in the operation of the new station has proved the location to be all that we could ask. Steps should now be taken to put in a permanent hatchery building and adequately equip it for operations. A 20-year lease has at last been obtained from the heirs of the North Estate with the privilege of purchasing at the expiration of the term of the lease.

If the improvements, as noted above, are made at the Bear Lake Hatchery and North Creek Station, we feel that a sufficient number of eggs of the rainbow trout can be secured and properly handled to adequately supply all the waters of southern California. Most of the eggs taken would, of course, be shipped to the Mount Whitney Hatchery, after being "eyed," from which station they would be distributed. This plan of operation is necessary, owing to the distance between Bear Lake and North Creek stations and the railroad. During the spring of 1917 a Ford auto truck was purchased for the Bear Lake and North Creek stations.

Almanor Hatchery. Almanor Hatchery is well equipped for hatchery and egg-collecting operations. It may be necessary, owing to the irregular water supply, to move the hatchery building to a spring below the dam at Lake Almanor. This will not be very expensive, as the distance from the present site is only a quarter of a mile.

Domingo Springs Station. Domingo Springs Station was overhauled and improved during the fall of 1917. A substantial cabin was put up, and a small hatchery under a frame covered with canvas constructed. The racks, traps, flumes and holding tanks are all in excellent condition and no repairs nor improvements are necessary at this time. A Ford auto truck has been purchased for use in operating the Almanor and Domingo Springs Station and also to distribute the trout fry. The machine was also used this season in connection with the operation of the Feather River Hatchery.

Feather River Hatchery. As stated in the fishcultural section of this report, the water in Grey Eagle Creek did not prove satisfactory for the propagation of fish, and it will, therefore, be necessary that a new site on one of the tributaries of the Feather River on the line of the Western Pacific Railway be selected. All of the hatching equipment, supplies, etc., have been stored at Blairsdon and can be moved to any location that may be selected.

Snow Mountain Station. Very few repairs are required at Snow Mountain Station, and these can be made when the station is opened for operations next spring.

Ukiah Hatchery. We have entered into an informal agreement with the Board of Trustees of the city of Ukiah relative to the operation of Ukiah Hatchery. The trustees agree to give us the use of the hatchery.

together with rights to the water supply, electric current, etc., which may be required in connection with the operation of the hatchery gratis upon our agreement to operate the station each season. They have also gone to considerable expense in repairing and improving the road leading to the hatchery. We have, therefore, repaired the electric power line, which was in very bad condition, and have made arrangements to repaint the hatchery troughs and make other certain minor repairs after the fish have been distributed this summer.

Brookdale Hatchery. We have made arrangements with the Mountain Light and Power Company for an adequate supply of water for the operation of Brookdale Hatchery during the summer months. Unless the extreme drought should cause the streams in that region to entirely dry up, a sufficient supply of water to keep the fish alive in the ponds is now assured. No improvements nor expensive repairs are at present required at Brookdale Hatchery.

Scott Creek Station. Scott Creek Station has been operated on the same plan during the past two seasons as in previous years, and is well equipped for carrying on the work without any improvements being made. Each season a sufficient supply of steelhead trout fry are planted in the creek to keep up the supply of spawn fish.

Wawona Hatchery. At a cost of \$550 the Wawona Hatchery was entirely rebuilt during the spring of 1918. Considerable trouble was experienced during the season with the flume furnishing the water for the hatchery, and before operations are commenced next spring a new flume will have to be built. The old one has been in use for a number of years and is in very bad shape.

Yosemite Valley Hatchery. With the increased number of tourists visiting the Yosemite National Park, it is essential that the streams and lakes of the valley be kept well stocked with trout fry. The only logical method of taking care of the requirements of this section is by the erection and operation of a suitable hatchery within the valley. A complete survey of the valley was made in October, 1917, and conditions were found to be most favorable for the establishment of a fine hatchery near Happy Isles. Accordingly, an application for a lease of the site selected as being most favorable for our requirements was made to the Department of the Interior through Mr. Washington Lewis, superintendent of the Park Service, who had assisted in our survey. The matter was taken up with Hon. Alex T. Vogelsang, first assistant secretary of the Department of the Interior, Washington, D. C., whose interest in fishcultural work is known throughout the country, he having at one time been president of the California Fish and Game Commission. A satisfactory lease was obtained in due time, and we have since been engaged in preparing plans and estimates of the proposed hatchery.

WATER POLLUTION.

Following is the report of our Inspector of Water Pollution:

“We are glad to be able to state, without fear of contradiction, that the waters of the state and the fish life therein have been more free from pollution during the past two years than at any time in the last two decades.

“This condition is partially due to the fact that the war has caused a shortage of materials and chemicals needed in the manufacture of munitions. The natural result has been that much, if not all, of the waste heretofore allowed to pass into state waters, because it was the easiest and cheapest way to get rid of it, is now being saved and treated for the more valuable by-products.

“In one case, at least, that of the Mason Malt Whiskey and Distilling Company, situated near Sausalito, the products of the ‘waste’ will be of more value than the alcohol, which was the chief product prior to the war.

“The waste from the stills, about 80,000 gallons per day, formerly passed into Richardson Bay, whereas it is now treated by process, which recovers potash, acetone, nitrogen, protein and caramel. The purchase and installation of the necessary machinery was hastened, owing to the fact that a complaint was filed charging a violation of section 635 of the Penal Code.

“The court allowed the company time in which to install the necessary equipment and perfect the process, and when the pollution ceased, the complaint was dismissed.

“Complaints were filed against the Milliff Refining Company of Rodeo, and the Shell Company of California of Martinez. Continuances were granted by the court upon the promises of the defendant corporations that immediate steps would be taken to remedy the evil. The work at the Shell Refinery will cost approximately \$40,000. The apparatus is now being installed and will handle the waste for all time.

“Several complaints have been filed against the Union Oil Company. One case went before a jury, and a verdict of ‘Not guilty’ was brought, notwithstanding the fact that expert testimony was introduced showing that 600 gallons of petroleum residue were discharged into San Pablo Bay per hour. Another case against this company is pending in Los Angeles. Cases are also pending against the Associated Oil Company and the Doheney Pacific Petroleum Company for pollution of Casmalia Creek, Santa Barbara County.

“Convictions were secured in San Luis Obispo County against the California Oil Company and the Tiber Pacific Company, and a fine of \$200 was imposed in each case.

“The Western States Gas and Electric Company has installed efficient lamp black filters in the Stockton and Eureka plants, and the Pacific Gas and Electric Company in the Oroville, Colusa, Woodland and Fresno plants, and increased the area of the filters in the San Francisco and San Jose plants.

“The Southern Pacific Company has appropriated \$18,000 for the construction of a concrete wall in the Sacramento River at Dunsmuir, for the purpose of collecting and retaining the petroleum which escapes

from the railroad property. Numerous other concerns were ordered to cease polluting the waters, and have in all cases complied with the law.

"Complaints having been made that oil-carrying ships were pumping bilges in the vicinity of the Farallon Islands, resulting in the destruction of bird life, an investigation was made to determine where the offense was being committed. Inspection showed that the pumping was being done outside of the three-mile limit, and therefore without the jurisdiction of the state. We then wrote to the heads of the marine departments of the three oil companies which own and operate the steamers asking their co-operation in an attempt to save the fast vanishing bird life of the Farallon Islands. Each company thereupon issued instructions to the captains of boats which quickly put a stop to this oil nuisance.

"Respectfully submitted.

"A. M. FAIRFIELD,
"Inspector of Water Pollution."

FISHWAYS AND SCREENS.

The installation of screens in the canals and ditches and the construction of fishways over the dams has progressed with the other work of the department.

Some delay was caused in districts where the drought of 1917 and 1918 affected the work, but considering conditions, we have been successful, and all of the better class of citizens have co-operated with us in the work of conserving the fish supply. Some of the large irrigation companies have shown a tendency to resist the law as they do nearly all other regulations that cause them any outlay of money other than to promote their interests.

The conservation of fish by the installation of screens and fishways is one of vital importance to all the people, and it can be done without interfering with the irrigation or power projects.

We have had some complaints regarding screens that were installed and did not prove satisfactory. In every instance where we have investigated we have found that the owners did not comply with our instructions, but put in some flimsy or ill-constructed screen that failed to do the work. Where the screens are built according to the plans given they never fail to be a success. Wherever the deputies have given particular attention to the fishways and screens we have been very successful.

We wish to call attention to the valuable co-operation given us in this work by deputies G. O. Laws, J. S. White, Geo. W. Courtright, M. S. Carpenter, T. W. Birmingham, J. S. Sanders, D. E. Roberts, H. D. Becker, E. W. Smalley and W. C. Malone. These deputies gave us valuable assistance in their respective districts.

Among the important ditches screened during the last two seasons are the following:

Phelan-Crouch ditch and Pacific Gas and Electric Company ditches in Butte County, Southern California Edison ditches in San Bernardino County, Anderson-Cottonwood Irrigation Company canal in Shasta County, Northern California Power Company canals in Shasta and Tehama counties, Pacific Gas and Electric Company ditches in Shasta County, and California-Oregon Power Company and McCloud River Lumber Company ditches in Siskiyou County.



Fig. 4. Views of the fishway at City Water Works Dam on the Napa River near Napa, California, one of the best fishways in the state. Photographs by A. E. Downey, August 4, 1912.

Of all the screens installed in the large canals in this state since the work was commenced in 1912, that of the Anderson-Cottonwood Irrigation District on the Sacramento River, Shasta County, is the most worthy of mention. (See Fig. 5.) It is the first attempt ever made to construct a rotary screen of large design, and the success of this installation is most gratifying to both the district and this department. The screen was designed by Mr. Thos. H. Means, consulting engineer, and Mr. A. R. W. Sperry, supervising engineer of the irrigation district, assisted by this department, and is patterned after the Southern California Edison type of moderate-sized rotary automatic cleaning screen. The device consists of three units, each nine feet long and twelve feet in diameter.

After four years efforts we finally entered into an agreement with the Northern California Power Company whereby they agreed to screen their eight large canals in Shasta and Tehama counties.

A portion of the screens were installed this summer, but owing to the impossibility of obtaining materials for them all, it will be the first of December before they are all completed.

The Stanford Vina and Durham ranches have at last contracted for efficient screens for their canals and ditches with Mr. R. W. Requa of Chico, California.

These screens will all be of the new "Draper" type recently invented by Mr. Requa. The Phelan-Crouch canal is screened with this type of screen, installed by Mr. Requa, and has given perfect satisfaction. A considerable number of screens have been installed by Mr. Requa during the past six months, and more are in course of construction. The delay in obtaining materials has interfered materially with the new construction in all sections.

The screen situation in Shasta County is especially satisfactory. Nearly every ditch and canal in the county which diverted water during this spring and summer is screened. Many rotary type screens were installed. In Modoc, Trinity, San Bernardino and Ventura counties all the larger ditches have been screened and work is progressing well on all smaller ditches.

The extreme drought has dried up many of the ditches in all parts of the state, particularly many of the smaller ones, and it was useless to insist on the owners of such ditches installing screens, but in many cases of this kind the owners have constructed the screens and have them ready for installation when water is again turned into the ditches next spring.

Fishways Surveyed, Constructed and Repaired.

County	No.	Location
Alameda -----	4	Bonito, Meek, Niles and Sunol dams.
Alpine -----	2	Hercules and Curtz (resurveyed for new).
Calaveras -----	1	Goodwin.
Colusa -----	1	Orland Irrigation Project.
El Dorado -----	1	Folsom resurvey and new work begun.
Inyo -----	3	Intake 4 and 5, Leffingwell.
Lake -----	3	Cold Creek—Kelsey Flour Mill and Kingery.
Mendocino -----	2	Junkins and Woodman.
Merced -----	1	Crocker-Hoffman.
Modoc -----	1	Shepard.
Napa -----	4	Benkiser, Hein, Napa Co., and Stretch.
San Luis Obispo -----	3	Delagama, Stroni, Guesa.
San Mateo -----	3	La Honda, Ormandale, Fitzhugh.
Santa Barbara -----	1	Gibraltar.
Santa Clara -----	5	Campbell, Ellsworth, Page, Sorosis, Stanford.
Santa Cruz -----	3	Zyante, Boulder Creek, Aptos.
Shasta -----	1	Backbone.
Sierra -----	6	Big Brandy City, Gillespie, Little Brandy, Sardine Lake, Sawmill, York.
Siskiyou -----	1	Huseman.
Sonoma -----	1	Mark West.
Tehama -----	2	Inskip and Vina.
Trinity -----	6	Big Creek, Alta Bert, Bull and Moxon, Gibson, Silcox and
—	—	Valdor.

We have made surveys as fast as our fishway surveyor could get out the work. Mr. Doney has been engaged in hatchery construction work

during a part of each season when the weather conditions were such that fishways could not be surveyed to good advantage or the fishways built.

To get out as many surveys and blue prints as possible during this coming season we have engaged a draftsman under a contract to make the tracings from the surveys so as to allow the surveyor more time in the field during the season that such work can be done.



Fig. 5. Screen installed in the Anderson-Cottonwood Irrigation District Canal, near Anderson, Shasta County, California. Photograph by A. E. Culver, May, 1918.

We have met with no resistance from any of the owners or occupants of dams except on the Merced River. There one of the large power companies is resisting the order to install a couple of cheap fishways, on the ground that there is not sufficient water to pass the fishways during the summer season and that the salmon do not ascend the river in numbers sufficient to justify the expense. There is ample water in the river in the spring and fall when the fish are ascending the river for the fishways and all power purposes, and there is also a good run of salmon in the Merced River, and if they are allowed to reach the spawning grounds on the upper reaches of the river they will soon increase and add materially to the salmon supply of Monterey Bay and the rivers tributary to San Francisco Bay and the San Joaquin River.

Respectfully submitted.

(Signed) W. H. SHEBLEY,
In charge, Department of Fishculture.

REPORT OF DEPARTMENT OF COMMERCIAL FISHERIES.

The Honorable Board of Fish and Game Commissioners:

SIRS: In our 1914-1916 biennial report we told of the increasing importance of California's commercial fisheries and pointed out some of the main things which should be done by the state if it were to encourage the development and at the same time safeguard the future of its fisheries. Most of the new laws suggested in that report were passed at the last session of the legislature with the result that the state's commercial fisheries patrol and conservation work has been put on a firm and substantial basis. This move was not made any too soon, for the enormous increase in the development of certain fisheries is making it difficult to obtain the information necessary for intelligent supervision. The most important fisheries work a state can do is to gather complete and accurate statistical data and our principal efforts have been along statistical lines.

Statistics of the Fisheries.

To facilitate the collection of fisheries statistical data, the legislature of 1915 passed a law requiring all fish dealers and packers to report monthly to the Fish and Game Commission the quantities of each species caught. As amended at the last session of the legislature, this law also requires dealers and packers to keep on file, for inspection, carbon copies of the receipts issued to the fishermen, in order that the Fish and Game Commission may collect more detailed information as to the catch of individual boats. Working under this law, we have gathered and compiled the data of the catch of each variety of fish. These figures have been published regularly in our quarterly magazine, CALIFORNIA FISH AND GAME.

The data collected in this manner have been of the greatest assistance in aiding the commission in its conservation work, and although the data are more accurate than those collected by other states, they are not accurate enough or detailed enough for the kind of fisheries work a state or a government should do. The reports by dealers or packers are often carelessly made and are apt to be inaccurate and incomplete. Dealers are not required to keep the copies of the receipts issued to fishermen for a longer period than six months, and even if they were required to hold them for a longer period there is no way of insuring their completeness nor of the commission acquiring from them the records of individual boat catches without a prohibitive amount of work.

It has usually been the custom of those gathering fishery statistics to judge the trend of a fishery by the total annual catch without taking into account the number of boats fishing or any of the other factors that enter in. If individual boat catches are not taken into account, a species of fish may be subjected to over-fishing and yet the total annual catch will still show an increase. Over-fishing is shown much earlier in the decreased catch of individual boats and in most cases by a growing scarcity of the larger and older fish. Over-fishing is not shown by a decreased total catch until the damage is already done and frequently done beyond repair.

The halibut fishery of the North Pacific had been carried on intensively without regulation. Each year saw an increase in the total catch and each year a higher price was paid for the fish and more boats were engaged in the business. Even the United States Commissioner of Fisheries gave it as his opinion that the banks were inexhaustible despite the fact that the Atlantic halibut banks had been depleted. A recent careful statistical study of the halibut fishery,* made at a time when the total catch was on the increase, demonstrated beyond a doubt that there was serious over-fishing and that the fishery was urgently in need of regulation. This study showed that the number of fish caught per unit of fishing year was fast decreasing. Also that there was a rapid decrease in the size of the fish, both of which facts show depletion. Since that time the total catch has fallen off.

The salmon supply of Puget Sound and the Frazer River was for years considered inexhaustible and many millions of dollars were invested in catching and canning the fish. Depletion of the fish was not recognized by the industries until they were facing bankruptcy, even though a warning was given by the Commissioner of Fisheries for British Columbia, whose investigations showed that not enough salmon were escaping the traps and nets during the "lean years" to properly seed the spawning beds. The companies, however, who had invested so heavily, opposed a radical restriction of the catch and hung on with the hope that by some phenomenon the runs would increase, and that on each fourth or "big year" they could make up for the decreased catch of the other years. Then came the big year of 1913 in which a huge rock slide in the Frazer River prevented all but a very few salmon from reaching the spawning beds. The fish resulting from the eggs deposited on the spawning beds that year were due to return in 1917, the year in which a big run would have been expected. As had been predicted, the run of 1917 was a failure and what has befallen the industry is nothing short of a calamity. The trouble is that depletion was not recognized until there was a heavy investment, and the catch could not be restricted

*W. F. Thompson, "Statistics of the Halibut Fishery of the Pacific." Report of the Commissioner of Fisheries of the Province of British Columbia, 1916.

without making the investments unprofitable. There was no early attempt made to determine when the catch had reached the limit of safety.

The point we have been leading up to is, that if a statistical study had early been started to show when the average catch per trap, purse or gill net, started to decline, depletion would have been apparent much earlier and the catch could have been restricted before in investment became so heavy and the companies would at least have been forewarned.

It is the duty of the state and of the governments interested, if they have the welfare of their fisheries at heart, to make every intelligent effort to determine at the earliest moment when any one fishery has reached its highest point of productivity beyond which depletion follows accompanied by the financial loss of those in the industry. The best and probably the only method by which this point may be determined is by a careful and accurate statistical study of the fishery. It is indispensable in such a study that a system be devised by which accurate and complete data of individual boat catches can be collected annually and filed for future study. Although no state or country, at the present time, has put into execution an efficient system of this sort, it is possible to do so without any great outlay of effort or money. Without fully realizing it, we were very near to devising such a system in our commercial fisheries tax bill, passed at the last session of the legislature, when we provided that all dealers and packers must keep a copy of receipts issued to fishermen. If the law had required that they make a third carbon copy of each receipt issued to fishermen, this third copy to be the property of the state, we would have had the ideal system proposed above. Under such a system more accurate and complete data of the catch of individual boats and of the total catch of each species could be obtained than is at present collected in any other state or country.

It has been necessary for the United States Food Administration, in setting the price which fishermen are to receive for fish, to know what is the average income of fishermen in certain fisheries. The income of the fisherman can not very well be determined without going into the statistics of individual boat catches. Also the Food Administration could not very well hold fishermen or packers and dealers to their contracts, which it is one of their duties to do, without having a record of all the sales of each fishing boat; both of which would be clearly shown by collecting a third carbon copy, as described above, from each dealer and packer. As we are assisting the Food Administration in its work so far as it has to do with the fisheries, we proposed, with their aid, to put into execution this triplicate system. Accordingly, books were printed with receipts in triplicate which have been adopted by all the dealers and

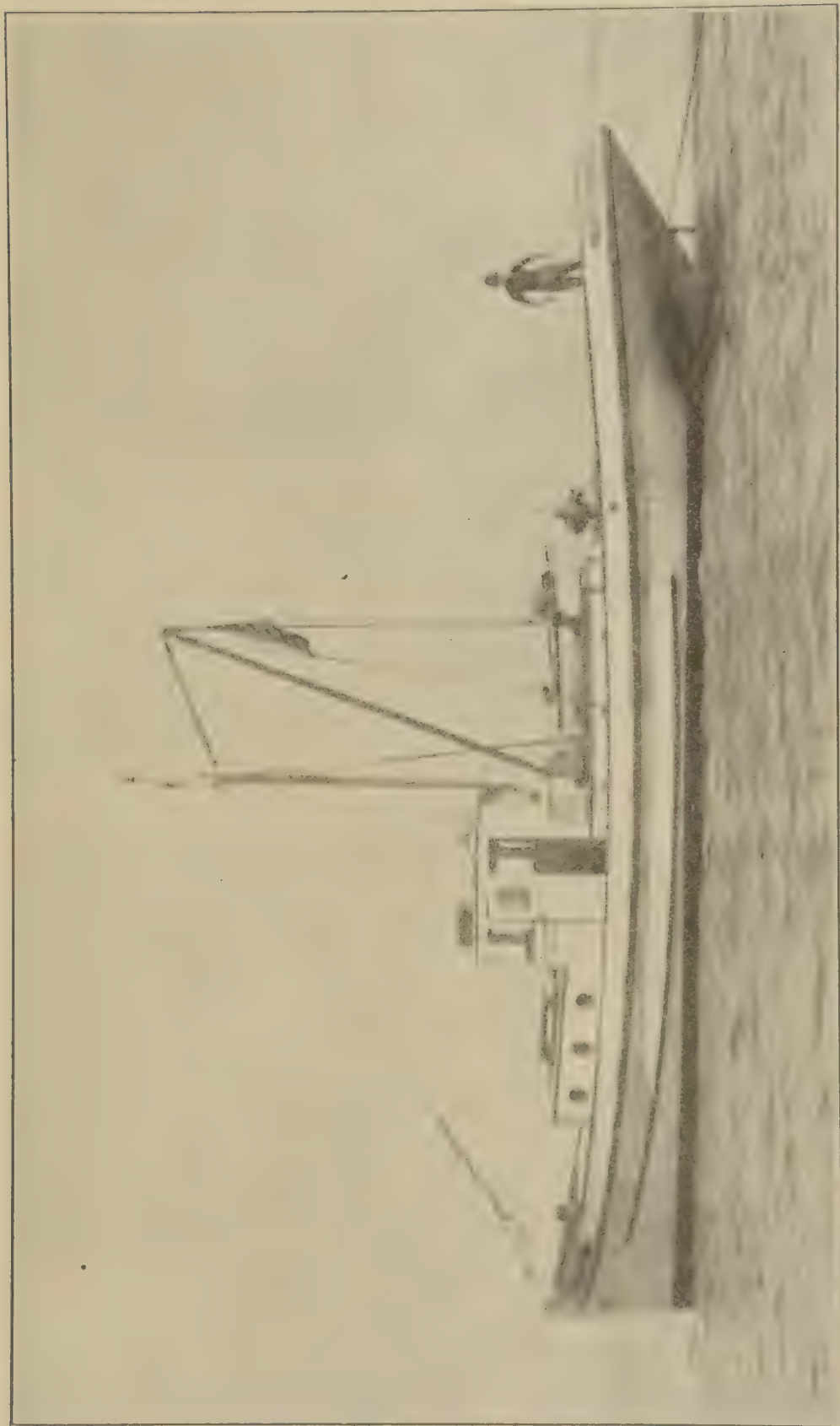


Fig. 6. Patrol boat "Albacore." This new patrol boat enforces fisheries laws in southern California, and is engaged in important investigation work. Photograph by W. F. Thompson, April, 1918.

packers in southern California and will, in a short time, be adopted in the northern part of the state. The receipts show the quantity and price of each variety of fish received, the date, the name of the boat and the owner, and the name of person or firm receiving them. The receipts are numbered serially and a record is kept of the numbers issued to each dealer or packer so that we may be sure we are getting the transactions complete. From these we get the amount of each variety of fish received by each dealer or packer, thus relieving them from making the monthly report now required. It has been necessary for us to employ two extra men for this work in the south, as we are collecting the receipts once a week, and part of the time, daily, for the convenience of the Food Administration. After the monthly records are compiled, the receipts are filed under the name of each individual boat so that we will have the complete catch of each boat for future reference. The system has worked with remarkable success.

Accurate statistical information which can be obtained by means of this triplicate system will be of the greatest aid in our conservation work and as such data gains immensely in value if continued over a long period of years, the state should enact a law which will perpetuate the system and put its fisheries work on a very much higher plane. Such a bill will be prepared for the coming session of the legislature and we are sure it will receive the unanimous support of all those in the industry and all who are interested in our fisheries.

Fisheries Tax.

The law which aids us now in the collection of fisheries statistics was further amended at the last legislative session so as to provide a tax of fifty cents a ton on fish received by packers, or curers for purposes other than for the fresh fish trade. All states and most countries, which are doing serious fisheries conservation work, derive a substantial revenue from their fisheries for the purpose. As the fish are among the few things which still belong to the people of the state it is perfectly proper for the people to demand of persons exploiting the fisheries that they pay to the state a modest sum for the privilege in order that this revenue may be used for the patrol and conservation work which is necessary to perpetuate the industries. This was the object of the commercial fisheries tax amendment bill. This bill became a law in July, 1917, and its passage by the legislature was in large part due to the approval, and support of the majority of the persons who were to be taxed.

The law provides that the money so received shall be used for the benefit of the fishing industry in the district from which it is derived. This tax rate, while it is hardly one-half what is required by other states, is probably sufficient for the present, due to the great increase in the

fish canning industry. However, there is one regrettable feature in the law and that is that herring and buck shad were exempted from the tax on the ground that the buck shad were of little value and that the herring were being canned as an experiment with little chance of the experiment proving profitable. In reality, the two fish were being taken, not in an experimental manner, but by the millions of pounds. The shad were already showing alarming signs of depletion under the heavy fishing. The herring were not showing signs of depletion as yet, but, as explained above, investigations need to be made in advance if we are to detect depletion before it is evidenced by a reduced catch and the persons who are taking the people's property for their personal benefit should pay for that privilege, at least enough to do the work necessary to preserve the fishery for the state's future generations.

But, we are not neglecting the fishery on that account. We are doing special investigation work on the herring as it is very important that data be collected and observations made as early in the development of a fishery as possible if we are to get the continual maximum production from that fishery.

With the revenue derived from the fisheries tax we have been able to go ahead and provide for the patrol work necessary to enforce the fisheries laws and to provide for the investigations necessary for the conservation of the fisheries.

The gathering of statistics and the compiling of data has necessitated the employment of three new men. Furthermore, the work has been greatly facilitated by the establishment of branch offices at San Pedro and San Diego. The office at San Pedro is located on Fisherman's Wharf and here the statistical files for the southern part of the state will be kept. This will be a headquarters where information may be obtained by fishermen or anyone else interested in the fishing or kelp industries. A laboratory for the use of our fishery experts will also be established at this office.

For patrol and investigation work it was necessary to provide a sea-going launch for southern waters. This was done. On the seventeenth of February, 1918, the Fish and Game Commission finished and put into commission its new patrol boat "Albacore" to be used in the waters of southern California. We have for several years needed a boat in that section of the state for patrol and investigation work, but the very rapid growth of the fisheries south of Point Concepcion during the last ten years, coupled with the fact that the harvesting of kelp had to be regulated, made it imperative that the boat be built at once.

The "Albacore" is a well designed and sturdily-built boat, well adapted for the work she will have to do. She is 60 feet long overall, with a 12-foot beam and draws 5 feet of water. She is powered with a

65-horsepower distillate burning engine and has a speed of about 10 knots. Her engine is fitted with pilot-house control. There is a combination salmon trawl winch and gurdy to aid in the handling of nets and fishing gear. The winch and a power driven capstan are operated by friction drive from the main engine. The boat is rigged with a single mast and boom and carries sail which is used as an auxiliary to the power plant when necessary. She is fitted with fuel tanks holding 1,125 gallons of distillate, which will carry her over 1,200 miles without replenishing the fuel. There is an ample hold aft for the storage of nets and gear and material collected for scientific purposes. The living quarters are roomy and well equipped, there being good accommodations



Fig. 7. Sardine boats at Municipal Pier, San Pedro, California. Photograph by W. F. Thompson, August, 1918.

for six people. The galley, though small, is compact and will take care of all hands in good shape. There is a water-tight bulkhead amidships between the living quarters and the engine room. The boat is equipped with a 30-volt Edison generating plant which furnishes light throughout. (See Fig. 6.)

Investigations.

For the investigation and statistical work it was necessary that we get as good a man as possible who had been trained in such work. Men of this type are very scarce, but we were fortunate in being able to secure the services of Mr. W. F. Thompson, formerly with the Department of Fisheries of British Columbia. He took up his duties June 1, 1917, and immediately tackled the problem of the albacore (tuna) fishery, as being the most urgent of solution. Long Beach was selected as headquarters

as the work at first was principally statistical and it was desirable to be near the largest number of canneries. As the work progressed it was found necessary to employ assistants to hurry it along and to secure a suitable place in which to work. A laboratory was therefore established at 920 East Ocean avenue, Long Beach, and this laboratory is the headquarters for our investigation work in southern California.

The scope of the work has now been extended and a study of the sardine and herring begun, as well as a general study of the fisheries as a whole. The new launch "Albacore" besides its patrol work is aiding the investigators by using young fish trawls and by experimental fishing. The headquarters of the launch was also established at Long Beach, where the city has generously donated the use of the Municipal Wharf and space in their warehouse for the storing of nets and supplies.

More recently we have added Mr. Elmer Higgins to our staff of investigators, to act as an assistant to Mr. Thompson and to take charge of the investigation work carried on by the launch "Albacore." Mr. Higgins had had good training for this work. He is a graduate in zoology of the University of Southern California and while a student there, had charge of the marine laboratory's boat, the "Anton Dohrn." Until his present employment he was teacher of zoology in the Pasadena High School.

The fisheries investigation work is progressing rapidly and already much has been accomplished, and progress reports will now begin to appear on the life history of the albacore, together with a statistical analysis of the catch. In our fisheries conservation work we are making use of the best methods which are employed in this and foreign countries. Fisheries conservation can hardly be termed a science as yet, at least in the sense we speak of the new science of forest conservation, but it is becoming a science in the same sense as the science of forest conservation. In the development of this new science we expect to take active part, for we have the men and we also have the guns in the form of facilities for carrying on the work.

There is a popular belief that the fish of the sea constitute a source of food supply that is inexhaustible. If such were the case, fisheries conservation work would not be necessary. It is this rather general belief in the inexhaustibility of the sea fishes that has held back the science of fisheries conservation. We have seen one species of fish after the other exhausted or approach exhaustion, and our good sense should tell us that the statement that any species of fish is inexhaustible is foolish. It is only necessary for the demand to be great enough and the species will be depleted. It is remarkable how quickly a great demand will deplete a species which is considered inexhaustible, as

for instance, the halibut and salmon. This subject of depletion and the character of fisheries conservation work that a state or country should do is handled rather fully in a paper by W. F. Thompson which will appear shortly in Fish Bulletin No. 2 of the Fish and Game Commission.

This state has seen the commercial extinction of the sturgeon and Sacramento perch, and now their sale is prohibited. We have seen the depletion of the salmon, shad, striped bass, tom cod, California halibut, crab, shrimp and abalone, and they have all been given more or less adequate protection. We have several species such as albacore, yellow-tail, sea bass, barracuda, sardine and herring, which need to be carefully watched. But we have many excellent varieties of fish which are little known and, therefore, little sought after by the people. The use of these fish should be encouraged, not only to remove the strain on the varieties now used to the limit of safety, but in order to increase the productivity of the fisheries. Our sea fisheries are new and in many respects still in a rather primitive state. The public takes very slowly to new varieties of food, especially food fish, and it is not to be wondered that they have not developed a desire for these new varieties. These varieties can be obtained in large quantities and placed on the market more cheaply than the well-known varieties, for if they were in demand the catch of the fishermen would be more stable and fish now thrown away or not sought after would be brought in. It occasionally has happened that there has been a "fish famine" when the little known varieties could have been obtained in large quantities if there had been a market for them. One instance of this happened last summer in southern California. The markets for some time were almost bare of fish while immense schools of mackerel, a very excellent fish, were along the coast, close to shore, where they could have been caught even by a novice.

To bring about the use of these little known varieties, it will be necessary to repeatedly and continuously tell the people about them and at the same time see that they are presented to the people in a fresh and wholesome condition. The United States Bureau of Fisheries has recognized this as necessary and has been doing excellent work along these lines. It has succeeded in introducing several new varieties of fish. While the public is to blame for the comparatively high price of the two or three varieties which they demand at the exclusion of the others, much could be said about the primitive and often filthy manner in which the fish for the fresh markets are handled by the fishermen and the wholesale and retail fish dealers. Reforms in the manner of handling of fish must be brought about coincident with a campaign to popularize the use of the little-used varieties, if the fresh

fish business is to be materially increased in this state. The great advance of our albacore (tuna), sardine and herring fisheries has been brought about by systematic advertising and at the same time by giving the people a clean, wholesome and attractive canned product. In the same manner the people can be induced to use in their fresh state the many excellent varieties which are now scarcely used.

Kelp.

Just before the 1917 session of the legislature, those companies interested in the harvesting of kelp for the extraction of potash, met together for the purpose of obtaining state regulations for the cutting of the beds. They elected to have the Fish and Game Commission handle it for them, for the reason that the Fish and Game Commission had jurisdiction over the kelp and for the further reason that this commission could do the patrol work necessary and regulate the cutting better and more economically than any other institution of the state. Together with the kelp companies, the United States Department of Agriculture and the Scripps Institution, which has from the first been identified with the government in the early surveys of the kelp beds, the bill was worked out which was finally passed by the legislature. We had great difficulty in drawing up a satisfactory law for the reason that the Fish and Game Commission does not have discretionary power and could not, it was decided, apportion the beds to the companies. Any ruling issued would have to be general and apply to all companies alike. This has been overcome in a large part by a "gentlemen's agreement." Arbitrators were chosen from the Fish and Game Commission and the Scripps Institution to settle disputes. So far the arrangement has worked better than would have been expected, but if it should happen that the kelp beds are overtaxed and the competition between companies becomes too great, the Fish and Game Commission should have the power to apportion the beds, otherwise regulatory laws would have to be passed which would necessarily be complicated and at best would not meet the conditions adequately. The original bill provided for a tax of one and one-half cents per ton of wet kelp cut, the revenue to go to the Fish and Game Commission, to cover the expense of regulation, patrol and scientific investigation work. The bill was amended so that one-third of the revenue would go to the state university fund for the Scripps Institution for kelp investigation work. While the kelp beds do not contain the amount of kelp estimated by the government, they produce enough for all the companies now operating. About 400,000 tons a year are being cut. With the knowledge that is being acquired in extracting the potash and the utilization of by-products, it is now fairly certain that the industry will be able to continue even if the price of potash falls to what it was before the war.

Sardine Industry.

As the progress of our fisheries work and the main features of the development of the fisheries is being handled in our quarterly publication, CALIFORNIA FISH AND GAME, and in special reports or bulletins, it is not desirable to take up the limited space of this report with special articles or to record the condition of each principal fishery as has been done in the past. There is one great outstanding feature, however, which we can not pass without comment and that is the rapid and substantial growth of the sardine industry.

In our last Biennial Report we told of how the sardine industry had sprung in a few years from unimportance to a position where it was crowding the salmon for second place. Since that time it has not only passed the salmon in importance but it has swept past the albacore into first place. The catch of sardines in 1917 was a little over 106,000,000 pounds, or 10,000,000 pounds more than the total catch of all fish in 1916. Over a million cases were packed last year and the pack of 1918 bids fair to equal two million cases. Over thirty canneries are now packing sardines in this state, most of them located at Santa Cruz, Monterey, San Pedro, Wilmington, Long Beach and San Diego. They are putting out as good an article as the French and at least ten of our canneries are putting up a better quarter oil sardine than the best that is packed in France. The French sardine has always been considered the best, but our fish which is a true sardine (*Sardinia caerulea*) and closely related to the species of Europe, is unsurpassed for its quality and flavor, and they are being packed in a better manner than the European fish. Our sardines are now finding a market all over the world, or at least wherever the War Trades Board will allow them to go. They are bound to supplant the European fish in this country. California is the only state which is packing a true sardine, the so-called sardine of Maine being a young herring much inferior in every way to ours. So rapid has been the growth of this industry that a majority of our people do not know sardines are packed in the state and most of those who do know it are firmly of the belief that our sardines are all large and are put up only in the oval one pound cans. Our fishermen to start with were unskilled in catching the small or young sardines and it was extremely difficult for the first cannery to get even the large fish. With experience, they have learned to catch both the large and the small sardines in immense numbers throughout the entire year. Canneries which in southern California were canning only albacore (tuna) are now canning principally sardines.

Due to the enterprise of our canners they profited by the early experience of the packers in Maine and got together and established a rigid system of inspection under the auspices of the National Canners'

Association, which is a guaranty that the fish are handled in a clean, sanitary manner and that they are properly and neatly packed and that the finished product is of a high grade. The individual packer can go as far beyond the standard set by the inspection as he pleases, both as to the quality of the oil and the care and skill used in cooking and packing. For that reason the people should learn to distinguish between the brands and determine, each for himself, which suits him best, for there are many brands and many different styles of pack.

Respectfully submitted.

(Signed) N. B. SCOFIELD,
In Charge, Commercial Fisheries.

BUREAU OF EDUCATION, PUBLICITY AND RESEARCH.

The Honorable Board of Fish and Game Commissioners of the State of California.

GENTLEMEN: We have the honor to submit herewith the second biennial report of the Bureau of Education, Publicity and Research, covering the period from July 1, 1916, to June 30, 1918.

EDUCATION.

Wild Life Films.

In January, 1917, the commission purchased a used set of the Salisbury wild life films. It seemed fit that the commission should own the only set of these films in the state since it was so largely concerned in their promotion in 1914. The films continue to be popular and they have been widely used. They have proved especially valuable in the educational work carried on in the high schools of the state. In most instances the films have been accompanied by a lecturer who explained the pictures and emphasized wild life conservation. The films, with lecture, are furnished free of charge to organizations or schools, provided they furnish the lantern and operator. The director of the bureau has on several occasions made extensive trips, showing these films at different places each day.

Lectures.

In addition to the lectures given with the films, nearly one hundred lectures, illustrated with lantern slides, have been delivered. Many organizations have availed themselves of the opportunity to obtain dependable information on California wild life. The title of the lecture most often given was "Methods of Wild Life Conservation."

Exclusive of regular courses of lectures at the university, over 26,000 persons have heard a conservation message as a result of our lecture

schedule. The following summary will give some idea of the extent of the bureau's activities during the biennium: Lectures in high schools, 13; normal schools, 2; grammar schools, 15; women's clubs, 12; boy scouts, 9; campfire girls, 2; churches, 2; miscellaneous, 38.



Fig. 8. Map showing lectures given by the Bureau of Education, Publicity and Research, 1916-1918.

As in former years, a series of nine lectures on fish and game was given in a course in general forestry at the University of California. These lectures were open to the public and many persons were constant visitors. This past year an attempt was made to make the course still more practical by taking members of the class on short field trips to

give them a first-hand acquaintance with common birds on the campus. The interest shown by the students is abundant evidence that these lectures are very much worth while and that these students will, as a result, teach and preach wild life as well as forest conservation. Both in 1917 and 1918 the lectures to prospective teachers in a course in advanced vertebrate zoology in the University of California have been continued. In 1917 several lectures were also given in a zoology course based largely on the bird and animal life of the bay region. A public lecture was given at both the University of California and Leland Stanford Junior University.

We believe that no more fundamental work can be done by this bureau than that to be seen in the instruction of university students. Unless it be the teacher, no one is in a better position to stimulate interest in fish and game conservation than the man or woman leaving the state university. Sufficient knowledge of game and game conditions makes of them missionaries for the conservation cause.

The vacation camps and mountain resorts of the state afford an opportunity for educational work which has been largely neglected. The summer vacationist, finding himself in close touch with nature, is in a particularly susceptible mood so far as information on wild life is concerned. A beginning was made in this fertile field when three lectures were given at camps in the Yosemite Valley during the season 1918.

The bureau has continued to stimulate interest in nature study and in field trips. A reorganization of our methods of teaching nature study in the schools would result in added interest and a greater stimulation of the desire for better conservation. Descriptions and pictures in books, although helpful, are not to be compared with the first hand knowledge obtained by field excursions. Some things must be taught indoors, but certainly our knowledge of wild life should come from a first-hand acquaintance whenever that is possible. Fortunately, city parks offer opportunities to city children which should not be neglected.

It has been our aim to furnish helpful material both in literature and specimens to all teachers making application. Two collections of bird's eggs, properly labeled, made up from discarded collections, have been furnished to the San Francisco Normal School and the Fresno Normal School. A small collection of bird's skins which we have accumulated has been loaned out several different times. We are convinced that a good working collection of study skins of common birds would be found very useful by the high schools in this state. This collection could be kept on the move with no expense to the commission.

Boy Scout Co-operation.

The bureau has continued to enlist the co-operation of boy scouts. Lectures and field trips have been given different troops and a special department in the quarterly has been devoted to reports made by scouts. A plan has now been developed to further stimulate interest by giving talks and conducting short field trips in some of the summer camps (see Fig. 9). Work of this sort during the summer of 1918



Fig. 9. Oakland boy scouts in camp in Yosemite Valley, June, 1918. These boys were given instruction in wild life conservation and were taught to recognize birds and mammals in the open. Photograph by Pillsbury.

gave splendid results. The out of doors is the best place to teach wild life conservation and the proper training of the boy assures the proper attitude toward wild life in the future.

Publications.

No addition has been made to our series of teacher's bulletins but many useful articles which appeared in CALIFORNIA FISH AND GAME have been reprinted in sufficient numbers to make them available to teachers and others interested. Notable among such articles are a series by Professor E. C. Starks of Stanford University on some of the food fishes of our state. These articles are of a popular nature and give splendid illustrations suitable for use in identification. There has also been made available an outline history of the introduction of food and game fishes in the waters of California. This paper, written by W. H. Shebley, in Charge of Fishculture, should be of great historical value.

At the request of the State Forester this Bureau furnished an article entitled, "Protection of Fish and Game" for the 1918 Handbook of Forest Protection. Articles were also prepared for several sporting magazines.

The publication of a quarterly illustrated magazine, CALIFORNIA FISH AND GAME, has been continued. We believe there has been a marked improvement in both make-up and material. Two special numbers, one entitled the "Deer Number," and the other the "Herring Number," have been issued. Volume 3 (1917) contained two hundred pages and seventy-six illustrations. Volume 4 (1918) will contain about the same number of printed pages but many more illustrations. The editor is receiving an increasing number of articles from outsiders which add materially to the value of the publication. Increased interest in the quarterly is also shown by the numerous requests for it.

PUBLICITY.

In addition to the publicity gained through films, lectures, and through the quarterly, CALIFORNIA FISH AND GAME, a systematic attempt to furnish news items to newspapers has been made. At irregular intervals suitable publicity items are mimeographed and sent to the different news agencies and about eighty large newspapers in the state. Furthermore, as an aid in the war emergency we have issued a number of publicity items, designed to increase the use of fishery products, furnished by the Committee on Zoological Investigations of the State Council of Defense.

As an aid in a contemplated English sparrow campaign in Sacramento, this bureau took care of the publicity. Talks were made, lantern slides furnished, and many publicity items were sent to the newspapers in Sacramento.

Gratifying results in our publicity work are to be seen in the numerous newspapers which publish the items issued. Numerous halftones have been loaned to magazines and newspapers.

Exhibits were installed at the State Fair both in 1916 and 1917. In 1917 the exhibit was made jointly with the United States Forest Service. The displays of wild birds attracted most attention. A small exhibit of birds and animals of the forest was arranged for the Forest Officers Convention, held in Berkeley, and an extensive exhibit including frozen fish and wild ducks and geese was made at the Sportsmen's Show in Oakland, January 16-17, 1918.

RESEARCH.

During the biennial period several field investigations have been made. In May, 1917, the game refuge in Trinity County was investigated. The refuge appears to be respected by the residents and it

surely demonstrates the efficacy of the sanctuary method of conserving wild life. Deer appear to be greatly increased and the systematic destruction of predatory animals carried on by the Forest Service should still further improve conditions. As evidence of the increase of deer it might be stated that thirteen deer were seen to go to a deer lick within two hours.

The loafing grounds for ducks and geese situated just west of the Marysville Buttes were visited on February 2, 1918. Although the season had closed but two days before, thousands and thousands of mallards were seen. In fact, no estimate of the numbers could be made, but the water was black with ducks as far as the eye could see. Because of the weather conditions geese were not very numerous.

Work on the food of ducks in California has been continued. Over two hundred ducks' stomachs have been examined and the results compiled. A full report on the investigation will be published soon. A careful study of the food habits of the horned lark, based on the examination of over two hundred stomachs, has been carried on under the supervision of this bureau. This bird has been accused of destroying alfalfa, grain and beans. Definite information as to the food of these birds will help solve the question whether they are a benefit or a detriment. Many examinations of birds' stomachs including those of hawks and owls have been made and reports published.

This bureau has continued to compile data on the number of deer killed during each open season. The kill during 1916 as reported was 8,117. As only a part of the deer killed can be reported by deputies and forest officers, we are justified in estimating the kill in the open season as over twelve thousand. A compilation of the hunting accidents has also been made and published. The reports from the chief forest deputies of each national forest have been reviewed and the more valuable material extracted and filed according to species. Every definite note on the life history and habits of any species of game bird or mammal which we have secured has been added to our files. Definite information as to the status of the prong-horned antelope has been secured, including a census of the actual number of animals in the few herds left in this state (see Fig 10).

The director of this bureau is joint author with Joseph Grinnell and Tracy L. Storer of a book on "The Game Birds of California," which is now in press and will soon be available to those interested. It has not been possible to make the cost of this book sufficiently low to make it available to every sportsman and teacher. War conditions made it seem best to issue the book as one of the semicentennial series of the University of California. As a consequence the cost of the volume will be beyond the purse of the average person, even though no profit is to



Fig. 10. Map showing the former and present distribution of the prong-horned antelope (*Antilocapra americana*) in California. The numbers show the result of a recent census as to the actual number of individuals still existing in this state.

be made by either the authors or the publishers. However, a cloth-bound book of over six hundred pages and with sixteen colored plates and ninety-four drawings should be worth the cost price to anyone seriously interested in the game birds of our state. Introductory chapters deal with many of the problems allied with game birds of the state, and a full discussion of the distribution, life history and habits of each of the 103 game birds found in California is given.

Respectfully submitted,

(Signed) H. C. BRYANT,
In Charge Education, Publicity and Research.

LEGAL DEPARTMENT.

To the Honorable Board of Fish and Game Commissioners,

GENTLEMEN:

I herewith submit to you a report of the legal department of the commission for two years ending June 30, 1918. During this biennial period the number of arrests for violations of both fish and game laws were 1,797, the number of convictions had were 1,553, the amount in fines collected was \$31,639.50 and imprisonments totaled 2,465½ days. This department has given many opinions interpreting the fish and game laws of the state and has written hundreds of letters answering inquiries regarding these laws.

The district attorneys throughout the state are co-operating in every way with the commission in the enforcement of the fish and game laws, and in a large measure, the high percentage of convictions, which is 86.4 per cent, is due to this co-operation.

The number of arrests has decreased materially. This is due to the campaign of education inaugurated by the commission in teaching the people the value of fish and game, of the absolute necessity of protecting them during the breeding season, of having limited open seasons in which they may be taken, and of having a bag limit fixed by which the breeding stock may not be depleted and each species may be perpetuated.

The co-operation of the justices of the peace with the commission throughout the state is evidenced by the fact that in many instances jail sentences have been imposed upon violators without any alternative.

The work of compelling owners of dams to construct fishways has met with much success and some opposition. A number of hearings have been demanded by several of the public service corporations and, after evidence had been taken and submitted, the commission made orders instructing said corporations to install fishways.

The work of compelling owners of canals and ditches to place and maintain screens on their intakes has been progressing most favorably and a large number of owners throughout the state are complying with the orders of the commission to screen their intake, and in every way, with but few exceptions, are co-operating in saving the fish from destruction.

A number of actions have been prosecuted against the oil companies operating on the shores of San Francisco and San Pablo bays for depositing oil or residuary products of petroleum therein. Two of the companies have, since being proceeded against, installed devices that will prevent such pollution in the future. In San Luis Obispo County

oil companies operating on the banks of Edna Creek were convicted and fined for permitting oil from their wells to run into Edna Creek, polluting the creek for several miles.

The last legislature passed a law prohibiting the shipment of fish and game by parcel post. This law was ignored by the Postal Department, which claimed that the law was unconstitutional.

On September 11, 1917, one Frank Phocdovius was arrested in San Mateo County for shipping deer meat by parcel post, and on September 11, 1917, was tried and convicted and sentenced to pay a fine of \$25.00 or be imprisoned in the county jail until said sentence was satisfied, in proportion of one day's imprisonment for every dollar of said fine. The defendant filed a petition in the Supreme Court for a writ of habeas corpus, claiming that the law was invalid. On January 17, 1918, the Supreme Court rendered its decision, written by Mr. Justice Angellotti, discharging the writ and remanding the petitioner to the custody of the sheriff. The respondent was represented by Hon. Carl Westerfeld.

The postal laws prevented inspection of any packages shipped by parcel post and the market hunters and fishermen took advantage of this privilege and used it as a means to violate the law by shipping more fish or game than is lawfully permitted, and at the same time to make their apprehension and conviction almost impossible.

This decision takes from the market hunter and fisherman the last avenue through which the game and fish of this state may be unlawfully exploited.

On December 12, 1916, Assistant Fish and Game Commissioners Raymond B. Heacock and Richard Squires, while on patrol duty on Bouldin Island, San Joaquin County, were murdered. The body of Richard Squires was found in the boat adrift on the island and that of Raymond B. Heacock, having fallen overboard, was recovered some fifty days subsequent. Assistant Commissioner Squires was killed with a shotgun and Assistant Commissioner Raymond B. Heacock was killed with a rifle.

Three Italians were arrested the day following, at Pittsburg: Nino Lombardo, who had a gunshot wound in the right hand, Vicenzi Dimaggio and Frank Favalora, suspected of having committed the crime. Through the untiring efforts of Sheriff W. H. Riecks, Deputy George McAllister and Assistant District Attorney C. P. Rendon of San Joaquin County, the suspected men confessed to the killing of the officers. The defendants admitted they were engaged in unlawful fishing and the murder of the officers was committed in their attempt to place the violators under arrest. Nino Lombardo was tried for the

murder of Raymond B. Heacock and convicted of murder in the first degree and sentenced to imprisonment at San Quentin for the term of his natural life. Vicenzi Dimaggio was tried for killing Raymond B. Heacock and convicted of manslaughter and sentenced to San Quentin for a period of ten years. Frank Favalora was tried on both charges and was acquitted. This was an unfortunate miscarriage of justice, for they were all equally guilty of one of the foulest murders in the criminal annals of the state.

Assistant District Attorney C. P. Rendon, Sheriff W. H. Riecks and Deputy Sheriff George McAllister are to be highly commended for the able manner in which they discharged their respective duties in bringing these men to justice.

Assistants Raymond B. Heacock and Richard Squires gave their lives in the discharge of their duty and their names should be among those to whose memory the state owes all honor. The state should surround its officers with every safeguard in the discharge of their duties and this is one of the strongest reasons why the legislature should pass **stringent** laws respecting the possession of firearms.

Respectfully submitted.

(Signed) ROBERT D. DUKE,
Attorney.

STATE GAME FARM.

The Honorable Board of Fish and Game Commissioners.

SIRS:

During the past two years the work of the State Game Farm has been carried on at a very low expense. The lease under which the property has been held will terminate in the fall of this year. On account of this fact no attempt has been made to enlarge the work on the farm and nothing but temporary repairs on worn-out equipment have been made.

There has been no effort to raise large numbers of birds for stocking purposes as the liberal plants that have been made in the past years have been deemed sufficient to establish the birds in all parts of the State adapted to them if they find conditions congenial.

Some attempt has been made to induce private parties to take up the breeding of many of our species of game birds but on account of the fact that poultry can be raised so much easier and the prices secured have been so satisfactory, there has been very little desire on the part of breeders to take up the new work.

Breeding Stock.

In 1917 the breeding stock of ring-necked pheasants was reduced to a little over two dozen. With the small number reared in that year it was possible to slightly increase the stock and to rear some 200 young birds in the spring of 1918. Less than a dozen golden and silver pheasants complete the breeding stock of pheasants held on the farm at the present time.

A flock of about 75 valley quail has been kept on the farm and a number of these birds have been sold to breeders. A few young birds were reared in 1917 but the breeding season was a total failure in 1918, the birds failing to lay.

The stock of ducks has been greatly reduced and at the present time not more than 60 birds remain on the pond. No marked success was attained in breeding wild ducks.

Perhaps the most interesting development on the farm has been the breeding of a pair of Canada geese during the spring of 1918. A pair of these birds, which have been retained for several years past, nested in early April. From the five eggs but one young bird was hatched. This bird was successfully brought to maturity.

A half dozen deer, kept on the farm, have been of considerable interest to visitors but no success has been attained in breeding these animals.

As the plans are now, the farm will be abandoned in November 1918. As a consequence, this will probably be the last formal report of the State Game Farm which was founded at Hayward, California, in



Fig. 11. Canada geese and gosling on State Game Farm, Hayward, California. In the spring of 1918 a pair of Canada geese successfully reared one young bird. Photograph by H. C. Bryant, May 8, 1918.

November 1908. The maximum utility of the farm was found during the years 1910 to 1914, when a considerable number of ring-necked pheasants were reared and distributed throughout the state. Since that time no concerted effort has been made to produce birds for restocking purposes and the farm has been used largely as an experimental plant to determine the possibility of breeding different species of game birds and mammals.

Respectfully submitted.

(Signed) W. N. DIRKS,
Superintendent.

APPENDIX

FISH DISTRIBUTION BY COUNTIES, SEASON, 1916.

Mount Shasta Hatchery.

Counties	Rainbow	Eastern Brook	Loch Leven	Black-spotted	Steel-head	Salmon	German brown
Alameda	144,000						
Alpine	14,000	20,000	12,000				
Amador	30,000	100,000	50,000	60,000			
Butte	123,500	199,000	103,000		72,000	10,000	
Calaveras	62,500	12,000	152,000	132,000	5,000		
Colusa	25,000	47,000	29,000				
Contra Costa					27,000		
Del Norte						300,000	
El Dorado	70,000	168,000	108,000		60,000		
Fresno	34,000	72,000		60,000			
Glenn	6,000	3,000					
Inyo		98,000	48,000	15,000			
Kern	28,000	30,000	46,000	34,000	8,000		
Lake	46,500	48,000			88,500		
Los Angeles	87,000	12,000	50,000		87,000		
Marin		6,000			120,000		
Mariposa	44,000	4,000	82,000	63,000	46,000		4,000
Modoc	83,000	23,000			16,000		
Monterey	171,500		12,000				
Napa	24,000				135,000		
Nevada	180,000	122,000	94,000	231,000	75,000		
Orange	4,000				10,000		
Placer	96,000	138,000	68,000	102,000	88,000		
Plumas	138,500	182,000	258,000	34,000	92,500		
Riverside	14,000	20,000	10,000				
San Benito	13,000	8,000	16,000		6,000		
San Bernardino	20,000	50,000			50,000		
San Diego	20,000				10,000		
San Luis Obispo		1,000	3,000		24,500		
San Mateo	77,500				307,500		
Santa Barbara	7,500	5,000	11,000		125,000	25,000	
Santa Clara		18,000			15,000		
Shasta	131,000	78,000	104,000	27,000	47,500		
Sierra	46,000	40,000	36,000		10,000		6,000
Siskiyou	170,000	222,000	163,000	63,000	372,900	18,623,738	
Solano		20,000			20,000		
Sonoma		4,000	4,000		63,500		
Tehama	36,000	36,000	22,000		94,000		
Trinity	6,000	6,000	6,000				
Tulare	40,000	36,000	42,000	15,000	106,000		
Tuolumne	56,000	78,000	63,000	99,000	20,000		4,000
Ventura	28,000				290,000	25,000	
Yuba		4,000	4,000		4,000		
State of Oregon			25,000				
Mount Shasta Hatchery ponds		50,800					63,300
Totals	2,044,500	1,963,800	1,620,000	938,000	2,733,900	18,383,738	77,300

REPORT OF THE FISH AND GAME COMMISSION.

Fort Seward Hatchery.

Counties	Rainbow	Black-spotted	Steel-head
Humboldt -----	78,632	132,270	824,270
Mendocino -----			100,000
Trinity -----	16,000		
Totals -----	94,632	132,270	924,270

Tahoe Hatcheries.

Counties	Rainbow	Eastern Brook	Black-spotted
Alpine -----			100,000
El Dorado -----	48,000	14,700	2,085,000
Nevada -----	84,000	10,000	100,000
Placer -----	77,000	25,000	420,000
Sierra -----			61,000
Totals -----	209,000	49,700	2,765,000

Almanor Hatchery.

Counties	Rainbow
Lassen -----	108,000
Plumas -----	93,788
State of Nevada -----	100,000
Totals -----	301,788

Bear Lake Hatchery.

County	Rainbow
San Bernardino -----	750,000

Snow Mountain Hatchery.

County	Steel-head
Mendocino -----	184,000

Ukiah Hatchery.

Counties	Steel-head	Quinnat salmon
Humboldt -----		550,000
Lake -----	60,000	
Mendocino -----	305,000	406,000
Sonoma -----	125,000	
Totals -----	490,000	956,000

Brookdale Hatchery.

Counties	Steel-head
Monterey	60,000
Santa Clara	227,000
Santa Cruz	594,000
Totals	881,000

Yuba City Hatchery.

Counties	Shad
Sutter	719,000
Yuba	153,000
Totals	872,000

Marlett Lake-Carson Hatchery.

	Eastern Brook
State of Nevada	55,000

Transplantation.

Counties	Blue-gilled sunfish	Sacramento perch	Black bass	Striped bass	Catfish	Crappie
Fresno			1,830			
Kern	36					
Los Angeles	75					
Marin		28				
Monterey			10			
Orange				2,200		
Riverside				200		
San Benito			15			
San Diego				1,800		
San Luis Obispo				1,300		
San Mateo	25	17				17
Sonoma	18	18				18
Tulare		295	820		200	
Totals	164	358	2,684	5,500	200	35

REPORT OF THE FISH AND GAME COMMISSION.

Summary of Fish Distribution, Season 1916.

Hatcheries	Rainbow	Eastern Brook	Loch Leven	Black- spotted	Steel- head	Salmon	German brown
Mount Shasta -----	2,044,500	1,933,800	1,610,000	938,000	2,733,900	18,383,738	77,300
Tahoe -----	200,000	49,700		2,765,000			
Ukiah -----					490,000	956,000	
Fort Seward -----	94,632			132,270	924,270		
Brookdale -----					881,000		
Bear Lake -----	750,000						
Almanor -----	301,738						
Snow Mountain -----					184,000		
Marlett Lake-Carson-----		55,000					
Totals -----	3,399,920	2,038,500	1,620,000	3,835,270	5,213,170	19,339,738	77,300
Yuba City Shad Station, shad-----							872,000
Total trout -----							16,214,160
Total salmon -----							19,339,738
Total shad -----							872,000
Grand total -----							36,425,898

FISH DISTRIBUTION BY COUNTIES, SEASON 1917.

Mount Shasta Hatchery.

Counties	Rainbow	Eastern Brook	Loch Leven	Black- spotted	Steel- head	Salmon
Alameda					324,000	
Alpine	20,000		18,000	23,000		
Amador	38,000	74,000	70,000	75,000		
Butte	112,500	95,500	96,000		21,000	
Calaveras	125,000		86,000	145,000		
Colusa	58,000	16,000			38,000	
Contra Costa					30,000	
Del Norte		5,000		7,000		
El Dorado	174,000	164,000	202,000		200,000	
Fresno	35,000	56,000	93,000	90,000		
Glenn	18,000				2,000	
Humboldt		4,000				
Inyo		58,000	10,000			
Kern	62,000	12,000	16,000	9,000	16,000	
Lake	31,000	24,000			248,000	
Lassen	8,000	11,000			4,000	
Los Angeles	114,000	24,000				
Madera	10,000		10,000		20,000	
Marin	6,000	6,000			137,500	
Mariposa	64,000	18,000	34,000	116,000	36,000	
Modoc	62,000	22,000			8,000	
Mono		50,000				
Monterey	108,000		10,000		56,000	
Napa	27,000				196,000	
Nevada	300,000	114,000	220,000	99,000	158,000	
Orange	30,000				12,000	
Placer	114,000	192,000	72,000	33,000	28,000	
Plumas	222,000	114,000	80,000	6,000	172,000	
Riverside	40,000					
San Benito	18,000	8,000	8,000		18,000	
San Diego	94,000				61,000	
San Luis Obispo			10,000		300,000	
San Mateo	60,000				360,000	
Santa Barbara			10,000			25,000
Santa Clara	8,000	4,000				
Shasta	176,000	74,000	72,000		44,000	
Sierra	34,000	48,000	46,000		10,000	
Siskiyou	214,000	196,000	105,000	56,000	92,000	6,312,000
Solano		10,000	20,000		136,000	
Sonoma	10,000		10,000		161,500	
Tehama	190,000	12,000	8,000		8,000	
Trinity	45,000	40,000	28,000			
Tulare	282,000	10,000		30,000	56,000	
Tuolumne	81,000	103,000	96,000	182,000		
Ventura	46,000	8,000				25,000
Yuba	24,000	2,000			16,000	
Ponds Mount Shasta Hatchery		40,000	40,000			
Totals	3,040,500	1,617,500	1,468,000	874,000	2,972,000	6,362,000

Mount Whitney Hatchery.

Counties	Rainbow	Black-spotted	Steel-head
Fresno -----			20,000
Inyo -----	277,000	19,000	2,000
Kern -----			100,000
Santa Barbara -----			125,000
Mono -----	40,000		
Tulare -----		234,000	226,000
Ventura -----			242,000
Totals -----	317,000	253,000	715,000

Tahoe Hatchery.

Counties	Rainbow	Black-spotted
El Dorado -----	72,000	142,000
Nevada -----	12,000	76,000
Placer -----	145,000	448,000
Sierra -----	12,000	97,000
Totals -----	241,000	763,000

Tallac Hatchery.

County	Black-spotted
El Dorado -----	1,946,000

Fort Seward Hatchery.

Counties	Rainbow	Steel-head	Salmon
Del Norte -----	4,000		
Humboldt -----	117,000	1,268,000	491,000
Mendocino -----	12,000		
Trinity -----	10,000	44,000	
Totals -----	143,000	1,312,000	491,000

Ukiah Hatchery.

Counties	Steel-head
Mendocino -----	295,000
Sonoma -----	150,000
Totals -----	445,000

Snow Mountain Hatchery.

County	Steel-head
Mendocino	202,000

Brookdale Hatchery.

Counties	Steel-head
San Francisco	1,120
Santa Clara	284,000
Santa Cruz	500,000
Total	885,420
State of Minnesota	106,000
Total	983,420

Almanor Hatchery.

Counties	Rainbow
Lassen	100,000
Plumas	235,000
Total	335,000

Domingo Springs Hatchery.

Counties	Rainbow
Lassen	88,000
Plumas	38,000
Total	126,000

Bear Lake Hatchery.

County	Rainbow
San Bernardino	874,000

Wawona Hatchery.

Counties	Rainbow	Steel-head
Madera -----	50,000	35,000
Mariposa -----	97,000	33,000
Totals -----	147,000	68,000

Transplantation.

Counties	Black bass	Catfish	Blue-gilled sunfish	Perch
Butte -----	202			
Contra Costa -----	12			
Glenn -----	100			
Kern -----	1,025	30		
Lake -----	260			
Marin -----	50		50	35
Napa -----	50			25
Placer -----	203			
San Francisco -----	336	220	110	
San Luis Obispo -----		320	100	
Santa Cruz -----	60			
Stanislaus -----	435		90	30
Totals -----	2,733	670	350	90

Summary of Fish Distribution, Season 1917.

Hatcheries	Rainbow	Eastern Brook	Loch Leven	Black-spotted	Steel-head	Salmon
Mount Shasta -----	3,040,500	1,617,500	1,463,000	874,000	2,972,000	6,362,000
Mount Whitney -----	317,000			253,000	715,000	
Tahoe -----	241,000			763,000		
Tadlac -----				1,946,000		
Fort Seward -----	143,000				1,312,000	491,000
Ukiah -----					445,000	
Snow Mountain -----					202,000	
Brookdale -----					985,420	
Almanor -----	335,000					
Domingo Springs -----	123,000					
Bear Lake -----	874,000					
Wawona -----	147,000				68,000	
Totals -----	5,223,500	1,617,500	1,463,000	3,836,000	6,699,420	6,853,000
Total trout -----						18,844,420
Total salmon -----						6,853,000
Grand total -----						25,697,420

STATE GAME FARM, HAYWARD.

Distribution, Sale, Liberation, Etc., of Game Birds, July 1, 1916, to June 30, 1918.

Alameda County.

Date	Applicant	Address	Pheasants	Quail	Miscellaneous
1916					
Oct. 10	Mrs. A. S. Blake	Berkeley	2		
Nov. 6	F. M. Smith	Mount Eden	4		
Nov. 28	A. J. Merle	Alameda			2
1917					
Jan. 21	C. J. Lieberman	Berkeley		1	
Jan. 29	Henry Kahlke	San Lorenzo	1		
Feb. 19	Carrie Pestdorf	Hayward		3	
April 4	C. McCurrie	Alameda			4
May 1	Martin Welsh	Hayward			1
June 28	W. Kahlke	San Lorenzo	1		
Aug. 3	Heg r & Harris	Oakland		4	
Nov. 2	Peoples Water Company	Oakland	24		
Nov. 4	J. C. Cutting	San Lorenzo	30		
1918					
Jan. 3	Bay Cities Water Company	Oakland			4
Jan. 28	East Bay Water Company	Oakland			1
Feb. 24	W. N. Dirks	Hayward	4		
Mar. 14	A. J. Merle	Alameda		4	
Mar. 18	— — McCloud	Pleasanton	2		2
May 4	H. C. Cutting	San Lorenzo	12		
June 18	J. T. Brewis	San Lorenzo	15 eggs		

Contra Costa County.

1918					
Jan. 27	Oreste Adami	East Richmond	1	2	
June 15	H. P. Goodman	Walnut Creek		1	

Lassen County.

1917					
Sept. 20	John F. Wood	Susanville	2		

Los Angeles County.

1916					
Oct. 13	J. B. Lampman	Pasadena			5
Nov. 28	J. B. Lampman	Pasadena		2	1
Nov. 20	Sixth District Agricultural Association	Los Angeles	6	12	12
Dec. 14	Sixth District Agricultural Association	Los Angeles	2		2
1918					
June 8	H. L. Scott	Glendale		2	

REPORT OF THE FISH AND GAME COMMISSION.

STATE GAME FARM, HAYWARD.

Distribution, Sale, Liberation, Etc., of Game Birds, July 1, 1916, to June 30, 1918.

Monterey County.

Date	Applicant	Address	Pheasants	Quall	Miscellaneous
1916					
Nov. 3	Herbert Hume -----	Monterey -----	4		
Nov. 14	Herbert Hume -----	Monterey -----	1		
1917					
Nov. 9	Cifriani Avala -----	King City -----	18		

Nevada County.

1916					
Dec. 15	Jos. Henwood -----	Grass Valley -----	2		

Sacramento County.

1916					
Oct. 10	Geo. Neale -----	Sacramento -----	5		
Nov. 21	Chas. A. Paine -----	Sacramento -----	17	12	

San Benito County.

1917					
Jan. 26	Paicines Ranch Company -----	Paicines -----			1
Jan. 12	Paicines Ranch Company -----	Paicines -----			72

San Bernardino County.

1916					
Nov. 20	R. A. Foote -----	Colton -----	2		

San Francisco County.

1916					
Aug. 25	J. V. de Leveaga -----	San Francisco -----			4
Nov. 9	J. V. de Leveaga -----	San Francisco -----			2
Dec. 12	Montgomery Baggs -----	San Francisco -----	3		
1917					
Feb. 4	J. V. de Leveaga -----	San Francisco -----			3
Aug. 22	W. S. Wise -----	Hilo, Hawaii -----			12
1918					
Feb. 5	Golden Gate Park -----	San Francisco -----			1
May 15	J. V. de Leveaga -----	San Francisco -----			2
May 27	Dr. Roach -----	Angel Island -----	50 eggs		

STATE GAME FARM, HAYWARD.

Distribution, Sale, Liberation, Etc., of Game Birds, July 1, 1916, to June 30, 1918.

San Mateo County.

Date	Applicant	Address	Pheasants	Quail	Miscellaneous
1916					
Oct. 21	Walter Hobart	San Mateo			34
Dec. 7	A. E. Schwabacher	Menlo Park		4	
1917					
Feb. 5	Wm. Hagedorn	Menlo Park	1		
Dec. 14	W. H. Hobart	San Mateo			15
1918					
Feb. 2	W. H. Hobart	San Mateo			2

Santa Clara County.

1916					
Nov. 13	J. V. de Leveaga	Cupertino			1
1917					
Mar. 9	E. C. Behrens	Palo Alto	8		
Oct. 13	Fish and Game Commission	Liberated in	16		
1918					
Mar. 4	I. L. Koppel	San Jose	5		
Mar. 15	J. V. de Leveaga	Cupertino			2
Feb. 17	J. V. de Leveaga	Cupertino			2
May 31	Jos. Sloss	Mountain View	{ 15 eggs }		

Sonoma County.

1917					
May 9	Thompson Bros.	Petaluma			1
Nov. 20	Henry Hall	Valley Ford	8		

1916					
Dec. 9	S. N. Nicholls	Pittsfield, Mass.	2		
1917					
Jan. 16	T. Akahoshi	Korea		10	
Mar. 13	Game Farm	Mason, Michigan	26		
Mar. 17	Chiles & Co.	Mount Sterling, Ky.	30		
1918					
May 7	Lincoln Park Zoo	Chicago, Ill.			3
Totals			233	57	192
			89 eggs		

REPORT OF THE FISH AND GAME COMMISSION.

LION BOUNTIES.

Statement of Lion Bounties Paid by Fish and Game Commission, from January 1, 1915, to December 31, 1917.

County	1915	1916	1917	Total from October, 1907
Alameda				1
Alpine	1			1
Amador		1		9
Butte			1	31
Calaveras	3			11
Colusa	1			14
Del Norte	2	9	4	90
El Dorado		2	1	39
Fresno	1	1	4	15
Glenn			1	37
Humboldt	26	39	29	534
Imperial	1			1
Inyo	3	1		6
Kern	15	18	17	109
Kings			1	1
Lake	8	2	5	83
Lassen				6
Los Angeles	5	1	7	32
Madera	10	1	2	33
Mariposa	2	14	13	60
Mendocino	7	7	15	179
Merced				1
Modoc				3
Monterey	8	6	12	74
Mono		5		7
Napa				3
Nevada		2		5
Orange			2	6
Placer	1	4	2	32
Plumas			1	9
Riverside		3	4	20
San Benito	2	5	1	30
San Bernardino	1		1	15
San Diego	1	1	3	32
San Joaquin	2			2
San Luis Obispo	10	3	9	67
San Mateo				1
Santa Barbara	4	6	3	74
Santa Clara	1	4	2	14
Santa Cruz				1
Shasta	7	10	11	205
Sierra				6
Siskiyou	9	9	7	240
Sonoma		1	4	19
Stanislaus	1		3	7
Sutter				1
Tehama	4	1	3	150
Trinity	4	3	2	234
Tulare	8	8	4	67
Tuolumne	7	11	6	54
Ventura	7	1	8	36
Yuba				3
Totals	162	179	188	2,713

All claims for bounty must adhere to the following requirements:

The entire skin, with evidence of sex attached, of the mountain lion upon which a bounty is claimed, must be sent to the office of the Fish and Game Commission, San Francisco, all express or mail charges prepaid. Where only the scalp is sent, or in case the sex can not be positively determined, a bounty of but \$20 will be allowed. The skin should be either dried, tanned, or otherwise cured before shipment, as green skins spoil quickly, becoming very offensive and losing all value. Offensive green scalps or skins, or those sent charges collect, will not be accepted.

All hides and scalps received by the Fish and Game Commission will be destroyed unless full directions are given for return to claimant, or for other disposition. A tag

with name of claimant, together with shipping directions thereon, should be attached to hide or scalp. All return shipping charges must be paid by claimant or other person receiving package.

A claim must be made for each animal, upon a form provided by the Fish and Game Commission, whereupon must appear the names and addresses of the claimant and three witnesses. This claim must be acknowledged before a notary public or justice of the peace, and must bear the county clerk's certification to the genuineness of the justice's signature. If sworn to before a notary public this will not be required. Affidavits of witnesses are not required.

The claim must be accompanied by an account of the pursuit and killing of the lion, giving in detail the method used, number of deer carcasses left by the animal, and such other facts as may be of assistance to the commission in determining the damage done to deer and other game. Claim blanks will be sent upon receipt of written application to the Fish and Game Commission.

SUMMARY OF PROSECUTIONS FOR VIOLATIONS OF STATE FISH LAWS.

July 1, 1916, to June 30, 1918.

Offense	Number of arrests	Convictions	Acquitted and dismissed	Pending	Sentence suspended and probation	Number days imprisonment	Fine imposed	Fine collected
Fishing (market) without a license	95	92	3	2	25	60	\$1,030 00	\$645 00
Fishing (angling) without a license	130	118	13		23	55	2,352 50	1,682 50
Wholesale dealing in fish without a license; failing to render monthly fish reports	1	1			1		10 00	
Illegal fishing apparatus (nets, lines, spears, etc.)	54	25	19	10	3	3	1,005 00	\$82 00
Salmon—catching or possession, close season	4	4			1	50	100 00	100 00
Saturday and Sunday with net for salmon, shad or striped bass	8	5	3			400	500 00	
Striped bass—close season; underweight; exporting	20	16	2	2	10		365 00	265 00
Black bass—close season; excess bag limit; undersized	11	9	2		2	150	160 00	110 00
Trout—close season; excess bag limit; taking other than with hook and line; undersized; shipping by parcel post	137	119	17	1	10	75	2,763 00	2,228 00
Catfish—undersized or selling, close season	15	15			2		382 00	382 00
Sturgeon—possession, offering for sale, close season	1	1			1			
Spot-fin croaker—offering for sale, close season	4	4					75 00	65 00
Sacramento perch and salt water perch—possession, sale, shipment, close season; excess bag limit	7	5	2				205 00	205 00
Halibut—possession and sale, underweight	5	4	1	1			80 00	70 00
Barracuda—offering for sale underweight	1	1					20 00	20 00
Salt water eels—taking undersized	3	3					100 00	
Taking fish within 50 feet of a fishway	1		1					
Young of fish—taking or possession	7	5	2		2		40 00	40 00
Using explosives to take fish	10	4	6			59	600 00	600 00
Polluting waters—oil, sawdust, etc.	1	1		1			200 00	
Fishing with nets in restricted district	49	38	7	4	9	240	2,285 00	1,695 00
Crabs—close season; undersized; female	51	45	6		28	3	370 00	325 00
Clams—excess bag limit; undersized	78	76	2		2	217	1,387 00	1,154 00
Abalones—close season; undersized; excess bag limit; drying	101	93	8		12		2,085 00	1,630 00
Crawfish—close season; undersized and oversized	16	13	3				285 00	285 00
California dried shrimp and shells	11	10	1		2	305	1,100 00	60 00
Total fish cases	821	707	98	21	133	1,617	\$17,479 50	\$12,393 50

REPORT OF THE FISH AND GAME COMMISSION.

SUMMARY OF PROSECUTIONS FOR VIOLATIONS OF STATE GAME LAWS.

July 1, 1916, to June 30, 1918.

Offense	Number of arrests	Convictions	Acquitted and dismissed	Pending	Sentence suspended and probation	Number days imprisonment	Fines imposed	Fines collected
Violations—hunting license law	262	240	21	—	21	5	\$3,855 00	\$3,731 00
Deer—killing, pursuing, possession, close season; excess bag limit. Hides—female; evidence of sex removed, not properly tagged, failure to retain skin and portion of head bearing horns	153	123	24	7	17	486	3,760 00	3,247 00
Female deer and fawns—killing and possession	53	38	14	1	1	59	2,175 00	2,022 00
Spike bucks—killing and possession	30	27	1	1	3	—	1,260 00	1,225 00
Ducks—killing and possession, close season	92	80	11	1	7	1½	2,600 00	2,321 00
Ducks—excess bag limit	21	14	5	—	4	30	875 00	350 00
Ducks—using a trained animal for taking; night shooting, shooting from power boat in motion; selling without wholesale dealer's license	35	29	6	—	1	—	550 00	550 00
Quail—killing and possession, close season, trapping without permit	49	46	3	—	4	200	1,190 00	1,000 00
Quail—excess bag limit; buying and selling	3	1	—	2	—	—	25 00	—
Doves—killing and possession, close season; excess bag limit; possession of live birds without permit	23	21	1	1	—	—	580 00	580 00
Snipe, curlew, rail, plover and other shore birds—killing, possession, close season; excess bag limit	35	30	3	—	2	1	765 00	765 00
Pheasants—killing	3	2	1	—	—	26	75 00	49 00
Grouse, sage-hen—killing and possession, close season; excess bag limit	5	5	—	—	—	—	120 00	120 00
Wild pigeons—killing and possession, close season	6	5	1	—	—	—	125 00	125 00
Nongame birds—killing and possession	65	61	—	1	2	—	726 00	701 00
Cottontail and bush rabbits—killing and possession, close season; excess bag limit	34	32	1	2	2	—	670 00	630 00
Tree squirrels—killing and possession, close season; excess bag limit	6	5	—	1	2	—	75 00	75 00
Wild geese—killing and possession, close season; excess bag limit	11	9	1	—	4	—	150 00	150 00
Night hunting	68	57	10	4	7	—	1,625 00	1,225 00
Killing birds in cemetery	1	1	—	—	—	—	10 00	10 00
Illegal shipment of game—not properly marked; concealed package	1	1	—	—	—	—	100 00	100 00
Trapping fur-bearing mamma's without license	7	6	—	1	—	40	60 00	45 00
Taking song birds with net	7	7	—	—	—	—	300 00	200 00
Selling Bird of Paradise	1	1	—	—	—	—	15 00	—
Mountain sheep head and hides—possession	2	2	—	—	—	—	100 00	25 00
Total game cases	976	846	103	22	77	848½	\$21,896 00	\$19,246 00

RECAPITULATION.

Arrests:

Fish cases	821
Game cases	976
Total	1,797

Convictions:

Fish cases	707
Game cases	846
	1,553

Acquittals and dismissals:

Fish cases	98
Game cases	103
	201

Pending cases:

Fish cases	21
Game cases	22
	43

Total 1,797

Fines imposed:

Fish cases	\$17,479 50
Game cases	21,896 00
Total	\$39,375 50

Fines collected:

Fish cases	\$12,393 50
Game cases	19,246 00
Total	\$31,639 50

Number of days imprisonment:

Fish cases	1,617
Game cases	848½
Total	2,465½

SEIZURES OF FISH, GAME AND ILLEGALLY USED FISHING APPARATUS.

July 1, 1916, to June 30, 1918.

Ducks	11,265	
Rabbits (cottontail, hare)	126	
Deer meat	3,349 $\frac{3}{4}$	pounds
Deer hides and horns	29	
Poses	113	
Quail	337	
Non-game birds	693	
Geese	2,721	
Shore birds	74	
Pheasants	101	
Pigeons	3	
Grouse	2	
Miscellaneous game	1	
Tree squirrels	7	
Squirrel hides	41	
Beaver hides	7	
*Illegally used fishing apparatus, nets, lines, etc.		
Trout	276	
Striped bass	2,118	pounds
Salmon	9,302	pounds
Sturgeon	8,945	pounds
Black bass	238	pounds
Crabs	38 $\frac{1}{2}$	pounds
Crawfish or lobsters	4,490	
Clams	1,194	
Abalones	9,144	
Shrimps and shrimp shells	2,780	
Cockle clams	15,847	pounds
Miscellaneous fish	1,198	pounds
	12,513	pounds

TOTAL ARRESTS FOR A PERIOD OF SIXTEEN YEARS.

1902-1904	550
1904-1906	774
1906-1908	1,192
1908-1910	1,771
1910-1912	2,063
1912-1914	1,993
1914-1916	2,087
1916-1918	1,797
Total	12,227

*276 nets, lines, etc., represent about 16,739 fathoms or 100,435 feet.

Illegally used fishing apparatus, after condemnation in superior courts, is destroyed or sold by the board in accordance with law. All wholesome fish and game is donated to public and charitable institutions, from whom many grateful letters of acknowledgment have been received.

During the period from July 1, 1916, to June 30, 1918, there were 316 searches of markets, restaurants, private individuals, conveyances, etc., for illegal fish and game, made by deputies.

HUNTING LICENSE SALES.

Year Ending June 30, 1917.

County	Sales	County	Sales
Alameda	\$5,922	Riverside	\$1,580
Alpine	37	Sacramento	1,842
Amador	1,342	San Benito	1,040
Butte	2,493	San Bernardino	1,066
Calaveras	1,278	San Diego	3,474
Colusa	1,801	San Joaquin	1,376
Contra Costa	2,094	San Luis Obispo	1,439
Del Norte	513	San Mateo	1,769
El Dorado	1,201	Santa Barbara	699
Fresno	8,216	Santa Clara	5,635
Glenn	653	Santa Cruz	315
Humboldt	2,720	Shasta	2,071
Imperial	648	Sierra	216
Inyo	1,188	Siskiyou	3,247
Kern	3,376	Solano	2,556
Kings	1,613	Sonoma	5,155
Lake	920	Stanislaus	2,353
Lassen	958	Sutter	1,284
Los Angeles	7,595	Tehama	918
Madera	1,039	Trinity	920
Mariposa	250	Tulare	4,193
Mendocino	2,616	Tuolumne	1,115
Merced	2,369	Ventura	728
Modoc	—	Yolo	2,198
Monterey	1,590	Yuba	561
Mono	189		
Napa	1,987	County clerks	\$108,848
Nevada	1,283	Fish and Game Commission	61,958
Orange	1,682		
Placer	1,827	Total	\$170,806
Plumas	890		

HUNTING LICENSE SALES—1917-1918.

County	Sales	County	Sales
Alameda	\$7,615	Riverside	\$1,232
Alpine	55	Sacramento	849
Amador	1,340	San Benito	1,008
Butte	3,296	San Bernardino	688
Calaveras	1,273	San Diego	4,053
Colusa	2,156	San Joaquin	1,190
Contra Costa	1,898	San Luis Obispo	1,505
Del Norte	434	San Mateo	1,639
El Dorado	932	Santa Barbara	423
Fresno	8,637	Santa Clara	5,635
Glenn	829	Santa Cruz	287
Humboldt	3,477	Shasta	1,973
Imperial	737	Sierra	187
Inyo	1,285	Siskiyou	3,247
Kern	3,007	Solano	2,628
Kings	1,691	Sonoma	5,032
Lake	1,307	Stanislaus	2,353
Lassen	1,490	Sutter	842
Los Angeles*	—	Tehama	1,257
Madera	885	Trinity	749
Marin*	—	Tulare	4,298
Mariposa	281	Tuolumne*	—
Mendocino*	—	Ventura	728
Merced	2,749	Yolo	2,198
Monterey	1,347	Yuba	1,485
Mono	162	Sacramento office	5,240
Napa*	—	Los Angeles office	32,481
Nevada	1,223	San Francisco office*	28,745
Orange	1,966		
Placer*	2,083	Total	\$165,663
Plumas	890		

*Not complete returns.

REPORT OF THE FISH AND GAME COMMISSION.

ANGLING LICENSE SALES.

Year Ending December 31, 1916.

County	Sales	County	Sales
Alameda	\$3,815	Sacramento	\$1,218
Alpine	130	San Benito	266
Amador	837	San Bernardino	936
Butte	2,164	San Diego	699
Calaveras	858	San Joaquin	857
Colusa	611	San Luis Obispo	992
Contra Costa	837	San Mateo	730
Del Norte	369	Santa Barbara	944
El Dorado	1,225	Santa Clara	4,063
Fresno	5,405	Santa Cruz	536
Glenn	223	Shasta	1,777
Humboldt	2,642	Sonoma	3,312
Imperial	57	Sierra	444
Inyo	1,745	Siskiyou	3,122
Kern	1,179	Solano	1,284
Kings	898	Stanislaus	1,510
Lake	462	Sutter	285
Lassen	834	Tehama	757
Los Angeles	3,235	Trinity	439
Madera	536	Tulare	2,989
Mariposa	124	Tuolumne	1,110
Mendocino	1,831	Ventura	902
Merced	651	Yolo	559
Mono	503	Yuba	453
Monterey	740		
Napa	1,323	Sold by county clerks	\$69,646
Nevada	1,124	Los Angeles office	21,255
Orange	904	Sacramento office	3,070
Placer	1,564	San Francisco office	21,547
Plumas	1,988		
Riverside	643	Total	\$115,518

ANGLING LICENSE SALES FOR THE YEAR 1917.

County	Sales	County	Sales
Alameda	\$4,343	Sacramento	\$918
Alpine	144	San Benito	331
Amador	847	San Bernardino	626
Butte	2,382	San Diego	854
Calaveras	942	San Joaquin	750
Colusa	585	San Luis Obispo	1,242
Contra Costa	844	San Mateo	752
Del Norte	225	Santa Barbara	342
El Dorado	1,236	Santa Clara	4,148
Fresno	6,404	Santa Cruz	320
Glenn	190	Shasta	2,024
Humboldt	3,754	Sierra	425
Imperial	41	Siskiyou	3,093
Inyo	1,899	Solano	1,348
Kern	728	Sonoma	3,361
Kings	1,078	Stanislaus	1,670
Lake	323	Sutter	500
Lassen	1,508	Tehama	758
Los Angeles	1,939	Trinity	333
Madera	453	Tulare	3,419
Mariposa	193	Tuolumne	1,161
Mendocino	2,013	Ventura	786
Merced	1,037	Yolo	590
Mono	590	Yuba	370
Monterey	795		
Napa	1,274	Total	\$71,992
Nevada	1,194	Los Angeles office	28,029
Orange	838	Sacramento office	3,809
Placer	1,609	San Francisco office	21,742
Plumas	1,966		
Riverside	497	Total	\$125,572

FINANCIAL STATEMENT, FISCAL YEARS 1916-1917 AND 1917-1918.

Revenues.

Receipts in State Treasury for Fiscal Year 1916-1917.

June 30, 1916, balance in state treasury		\$46,650 60
Sale of hunting licenses 1915-1916	\$9,808 00	
Sale of hunting licenses 1916-1917	157,832 60	
Sale of hunting licenses 1917-1918	1,000 00	
Sale of angling licenses 1916	98,887 00	
Sale of angling licenses 1917	38,575 00	
Sale of trout farm licenses 1916	25 00	
Sale of wholesale fish and game dealer's license 1915-1916	5 00	
Sale of wholesale fish and game dealer's licenses 1916-1917	1,775 00	
Sale of market fisherman's licenses 1915-1916	10 00	
Sale of market fisherman's licenses 1916-1917	26,630 00	
Sale of market fisherman's licenses 1917-1918	21,520 00	
Fines paid for violations of fish, game and license laws	15,866 50	
Received from importers for inspection	1,892 26	
Sales of game farm products	915 45	
Sales of confiscated fishing gear	577 50	
Refunded by Department of Engineering Construction	600 00	
Sundry receipts—telephone installation, fares, gas, drums, etc.	161 66	
	\$376,080 97	

Less exchange and express charges paid by State Treasurer on remittances made by county clerks and justices of the peace

35 86

376,045 11

Receipts in State Treasury for Fiscal Year 1917-1918.

Sale of hunting licenses 1916-1917	\$13,006 40
Sale of hunting licenses 1917-1918	157,927 00
Sale of angling licenses 1916	79 00
Sale of angling licenses 1917	86,847 00
Sale of angling licenses 1918	46,166 00
Sale of market fisherman's licenses 1917-1918	20,590 00
Sale of market fisherman's licenses 1918-1919	22,190 00
Sale of kelp harvester licenses	330 00
Sale of wholesale fish and game dealer's license 1916-1917	5 00
Sale of wholesale fish and game dealer's licenses 1917-1918	895 00
Sale of fish importer's licenses 1917	10 00
Sale of fish importer's licenses 1918	10 00
Sale of game breeder's licenses 1917	22 50
Sale of game breeder's licenses 1918	40 00
Sale of trapping licenses 1917-1918	1,875 00
Sale of fish breeder's licenses 1917	15 00
Sale of fish breeder's licenses 1918	70 00
Sale of fish packer's and wholesale shellfish dealer's licenses 1917-1918	970 00
Appropriation for death benefits—Chapter 314	10,907 00
Fish packer's tax	24,934 60
Kelp harvester's tax	3,272 56
Sale of confiscated fish gear	866 00
Sale of fish marking tags for importation	371 01
Sale of game breeder's marking tags	22 17
Sale of products of game farm	579 50
Sale of Hat Creek Hatchery Building	100 00
Received from importers for inspection	2,774 46
Refund by Department of Engineering on construction	132 62
Fines paid for violations of fish, game and license laws	19,461 30
Refunds for telephone installation, freight fares, gas drums, etc.	148 07

Total

\$414,707 19

Less exchanges and express charges paid by State Treasurer on remittances made by county clerks and justices of the peace

23 71

414,683 48

Total receipts for fiscal years 1916-1917 and 1917-1918

\$837,409 25

Total disbursements for fiscal years 1916-1917 and 1917-1918

708,310 75

Balance in state treasury July 1, 1918

\$129,098 50

REPORT OF THE FISH AND GAME COMMISSION.

RECAPITULATION.

July 1, 1916, balance in state treasury		\$46,680 65
Receipts for fiscal year 1916-1917	\$376,045 11	
Receipts for fiscal year 1917-1918	414,683 48	
		790,728 59
Total		\$837,409 25
Less disbursements fiscal year 1916-1917	\$355,732 48	
Less disbursements fiscal year 1917-1918	352,578 27	
		708,310 75
July 1, 1918, balance in state treasury		\$129,098 50

DISBURSEMENTS FOR FISCAL YEAR 1916-1917.

General Administration.

Commissioners' traveling and other expenses	\$1,535 35
Salaries of administrative assistants	16,047 90
Traveling expenses of administrative assistants	2,032 05
Rentals, office and other supplies	3,813 70
	\$23,429 00

General Fish and Game Patrol.

San Francisco Division.

Salaries of deputies and employees	\$30,385 44
Traveling expenses and employees	20,297 35
Rentals, office and other supplies	1,879 85
	61,562 64

Sacramento Division.

Salaries of deputies and employees	\$27,692 58
Traveling expenses and employees	14,102 41
Rentals, office and other supplies	1,710 76
	43,505 75

Los Angeles Division.

Salaries of deputies and employees	\$16,165 74
Traveling expenses and employees	5,769 20
Rentals, office and other supplies	2,218 95
	24,153 89

Miscellaneous Fish and Game Expenditures.

Prosecutions and allowances	\$2,010 80
General printing	4,121 46
Accident and death claims	1,087 28
	7,219 54

Subtotal, general administration and patrol	\$159,870 82
Apportionment to game expenditures (60%)	\$95,922 49
Apportionment to fish expenditures (40%)	63,948 33
	\$159,870 82

Special Fishery Expenditures.

Administration.

Salaries of superintendent of hatcheries and assistants	\$7,040 84
Traveling expenses of hatcheries and assistants	1,263 27
Office and other supplies	1,081 47
	\$9,385 58

Mount Shasta Hatchery.

Salaries	\$14,946 96
Traveling expenses	111 05
Fish food and ice for meat	5,709 82
General expenses and supplies	2,064 16
Construction and repairs	717 03
	23,549 02

Klamath Station.

Salaries	\$1,403 24	
Traveling expenses	64 30	
General expenses and supplies.....	141 07	
		\$1,608 61

Mount Whitney Hatchery.

Salaries	\$2,160 04	
Traveling expenses	367 96	
General expenses and supplies.....	1,846 21	
Construction and repairs.....	58,700 86	
		63,075 07

Rae Lakes Station.

Salaries	\$867 00	
Traveling expenses	89 95	
General expenses and supplies.....	196 07	
Construction and repairs.....	547 51	
		1,700 53

Tahoe Hatcheries.

Salaries	1,983 66	
Traveling expenses	156 97	
General expenses and supplies.....	389 42	
Construction and repairs.....	6 29	
		2,536 34

Marlett Lake-Carson Hatchery.

Salaries	\$463 63	
Traveling expenses	77 20	
General expenses and supplies.....	177 44	
Construction and repairs.....	3 25	
		721 52

Fort Seward Hatchery.

Salaries	\$2,888 00	
Traveling expenses	109 28	
General expenses and supplies.....	1,037 52	
Construction and repairs.....	927 42	
		4,962 22

Ukiah Hatchery.

Salaries	\$458 17	
Traveling expenses	89 75	
General expenses and supplies.....	136 92	
		684 84

Snow Mountain Station.

Salaries	\$1,043 95	
Traveling expenses	225 35	
General expenses and supplies.....	526 02	
Construction and repairs.....	10 88	
		1,805 70

Brookdale Hatchery.

Salaries	\$834 50	
Traveling expenses	15 42	
General expenses and supplies.....	449 62	
Construction and repairs.....	2 75	
		1,302 29

Scott Creek Station.

Salaries	\$833 00	
Traveling expenses	18 45	
General expenses and supplies.....	46 11	
Construction and repairs.....	545 88	
		1,442 94

REPORT OF THE FISH AND GAME COMMISSION.

Almanor Station.

Salaries	\$1,619 83	
Traveling expenses	240 94	
General expenses and supplies	751 89	
Construction and repairs	1,675 87	
		\$4,288 53

Bear Lake Hatchery.

Salaries	\$1,392 50	
Traveling expenses	281 00	
General expenses and supplies	840 75	
Construction and repairs	36 87	
		2,551 12

Wawona Hatchery.

Salaries	\$128 23	
Traveling expenses	3 60	
General expenses and supplies	17 99	
Construction and repairs	18 28	
		168 10

Yuba City Shad Station.

Salaries	\$525 50	
Traveling expenses	135 30	
General expenses and supplies	382 61	
		1,043 41

Fish Distribution.

Salaries	\$3,318 67	
Traveling expenses and mess allowance	1,774 44	
General expenses and supplies	3,982 14	
Repairs	303 31	
		9,377 56

Fish Transplanting.

Salaries	\$487 63	
Traveling expenses	181 26	
General expenses and supplies	296 62	
		965 56

Screen, Fishway and Water Pollution.

Salaries	\$4,107 50	
Traveling expenses	1,720 29	
General expenses and supplies	116 29	
		5,944 08

Fishery Research and Publicity.

Salaries	\$3,932 90	
Traveling expenses	701 06	
General expenses and supplies	447 67	
		5,081 63

Launch Patrol.

Salaries	\$4,912 30	
Traveling expenses and mess allowance	1,823 09	
Repairs	556 19	
Supplies (oil, etc.) and general expenses	1,827 03	
		9,118 61

Fish Exhibits.

Salaries	\$1,024 11	
Traveling expenses and mess allowance	328 55	
General expenses and supplies	272 42	
		1,625 08

Miscellaneous Fishery Expenditures.

Printing and lithographing fishing licenses	\$1,168 05	
Angling license commissions and refunds	10,219 36	
Market fishing license commissions	1,256 50	
Crawfish inspection	1,805 59	
		14,449 50

Subtotal, fishery expenditures..... \$167,387 84

Special Game Expenditures.

Hayward Game Farm.

Salaries	\$1,517 50	
Traveling expenses	232 00	
Rent	487 50	
Food for birds.....	564 45	
General expenses and supplies.....	378 59	
Repairs	6 00	
		\$3,184 04

Game Research and Publicity.

Salaries	\$2,182 10	
Traveling expenses	188 50	
General expenses and supplies.....	815 24	
		3,185 84

Game Exhibits.

Salaries	\$42 00	
Traveling expenses	58 10	
General expenses and supplies.....	147 21	
		247 31

Miscellaneous Game Expenditures.

Printing and lithographing hunting licenses.....	\$1,174 49	
Hunting license commissions and refunds.....	16,922 10	
Mountain lion bounties.....	3,720 00	
Winter game feeding.....	40 04	
		21,856 63

Subtotal, game expenditures.....	\$28,473 82	
Total of fish expenditures.....	\$231,336 17	
Total of game expenditures.....	124,396 31	
Total	\$355,732 48	

DISBURSEMENTS FOR FISCAL YEAR 1917-1918.

General Administration.

Commissioners traveling and other expenses.....	\$1,065 19	
Salaries of administrative assistants.....	15,544 08	
Traveling expenses of administrative assistants.....	2,139 78	
Rentals, office and other supplies.....	3,837 76	
		\$22,586 76

General Fish and Game Patrol.

San Francisco Division.

Salaries of deputies and employees.....	\$42,171 73	
Traveling expenses of deputies and employees.....	20,918 73	
Rentals, office and other supplies.....	2,423 28	
		\$65,513 74

Sacramento Division.

Salaries of deputies and employees.....	\$27,760 10	
Traveling expenses of deputies and employees.....	14,685 36	
Rentals, office and other supplies.....	1,841 19	
		\$44,286 65

Los Angeles Division.

Salaries of deputies and employees.....	\$19,576 89	
Traveling expenses of deputies and employees.....	7,440 40	
Rentals, office and other supplies.....	2,103 17	
		29,120 46

Miscellaneous Fish and Game Expenditures.

Prosecutions and allowances.....	\$2,081 94	
General printing	2,994 07	
Accident and death claims.....	2,764 47	
		7,840 48

Subtotal, general administration and patrol.....	\$169,348 09	
Apportionment to game expenditures (66%).....	\$101,608 85	
Apportionment to fish expenditures (40%).....	67,739 24	
Total	\$169,348 09	

REPORT OF THE FISH AND GAME COMMISSION.

Special Fishery Expenditures.

Administration.

Salaries of superintendent of hatcheries and assistants.....	\$7,432 50	
Traveling expenses of superintendent of hatcheries and assistants.....	1,550 11	
Office and other supplies.....	1,285 11	
		\$10,267 72

Mount Shasta Hatchery.

Salaries	\$14,175 54	
Traveling expenses	79 72	
Fish food and ice for meat.....	4,019 16	
General expenses and supplies.....	2,250 74	
Construction and repairs.....	484 06	
		21,009 22

Klamath Station.

Salaries	\$1,252 50	
Traveling expenses	137 45	
General expenses and supplies.....	243 30	
		1,633 25

Mount Whitney Hatchery.

Salaries	\$7,623 52	
Traveling expenses	792 44	
Fish food and ice for meat.....	175 00	
General expenses and supplies.....	3,537 24	
Construction and repairs.....	2,185 28	
		14,313 48

Rac Lakes Station.

Salaries	\$490 50	
Traveling expenses	110 76	
General expenses and supplies.....	219 00	
		820 23

Cottonwood Lakes Station.

Salaries	\$178 50	
Traveling expenses	90 33	
General expenses and supplies.....	518 75	
		787 58

Tahoe Hatchery.

Salaries	\$305 75	
Traveling expenses	107 30	
General expenses and supplies.....	2,401 05	
Repairs	84	
		3,314 94

Tallac Hatchery.

Salaries	\$1,191 46	
Traveling expenses	175 25	
General expenses and supplies.....	730 54	
Repairs	11 61	
		2,108 86

Fort Seward Hatchery.

Salaries	\$3,073 00	
Traveling expenses	487 98	
General expenses and supplies.....	1,160 22	
Construction and repairs.....	226 93	
		5,548 13

Ukiah Hatchery.

Salaries	\$593 00	
Traveling expenses	167 90	
General expenses and supplies.....	209 29	
Construction and repairs.....	90 08	
		1,060 27

Snow Mountain Station.

Salaries	\$1,113 00	
Traveling expenses	264 47	
General expenses and supplies.....	329 86	
Repairs	26 55	
		1,733 88

Brookdale Hatchery.

Salaries	\$1,184 15	
Traveling expenses	102 90	
General expenses and supplies	662 50	
Repairs	71 02	
		\$2,020 57

Scott Creek Station.

Salaries	\$545 00	
Traveling expenses	27 95	
General expenses and supplies	9 25	
		582 20

Feather River Hatchery.

Salaries	\$279 00	
Traveling expenses	84 86	
General expenses and supplies	320 84	
Construction and repairs	707 19	
		1,391 89

Almanor Hatchery.

Salaries	\$791 37	
Traveling expenses	129 10	
General expenses and supplies	697 27	
		1,617 74

Domingo Springs Station.

Salaries	\$931 00	
Traveling expenses	204 07	
General expenses and supplies	258 04	
Construction and repairs	106 74	
		1,499 85

Bear Lake Hatchery.

Salaries	\$1,992 74	
Traveling expenses	296 55	
General expenses and supplies	1,266 95	
Construction and repairs	81 95	
		3,638 19

Wawona Hatchery.

Salaries	\$333 00	
Traveling expenses	33 65	
General expenses and supplies	6 15	
Construction and repairs	560 00	
		932 80

Fish Distribution.

Salaries	\$3,413 50	
Traveling expenses and mess allowance	1,946 20	
General expenses and supplies	2,640 65	
Repairs	1,461 40	
		9,461 75

Fish Transplanting.

Salaries	\$509 00	
Traveling expenses	198 60	
General expenses and supplies	185 27	
		892 87

Screen, Fishway and Water Pollution.

Salaries	\$1,650 10	
Traveling expenses	1,849 54	
General expenses and supplies	185 73	
		6,685 37

Special Field Investigations.

Salaries	\$363 50	
Traveling expenses	179 83	
General expenses and supplies	66 37	
		612 70

REPORT OF THE FISH AND GAME COMMISSION.

Fishery Research and Publicity.

Salaries	\$10,445 38	
Traveling expenses	4,539 77	
General expenses and supplies	2,622 51	
		\$17,607 66

Launch Patrol.

Salaries	\$4,403 92	
Traveling expenses and mess allowance	1,638 90	
Construction and repairs	16,817 83	
Supplies (oil, etc.) and general expenses	4,787 12	
		27,697 82

Fish Exhibits.

Salaries	\$150 00	
Traveling expenses and mess allowance	131 89	
General expenses and supplies	157 91	
		439 80

Miscellaneous Fishery Expenditures.

Printing and lithographing fishing licenses	\$1,441 05	
Angling license commissions and refunds	11 878 25	
Market fishing license commissions	1,079 75	
Crawfish inspection	1,328 93	
Papermill Creek dam	778 37	
		16,500 35
Subtotal, fishery expenditures		\$154,185 15

*Special Game Expenditures.**Hayward Game Farm.*

Salaries	\$1,525 00	
Traveling expenses	260 61	
Rent	450 00	
Food for birds	563 56	
General expenses and supplies	327 16	
		\$3,129 33

Game Research and Publicity.

Salaries	\$2,364 40	
Traveling expenses	298 17	
General expenses and supplies	433 61	
		3,096 18

Game Exhibits.

Traveling expenses	\$58 20	
General expenses and supplies	28 04	
		86 24

Miscellaneous Game Expenditures.

Printing and lithographing hunting licenses	\$1,488 93	
Hunting license commissions and refunds	16,754 35	
Mountain lion bounties	4,490 00	
		22,733 28

Subtotal, game expenditures

\$29,045 03

Total of fish expenditures	\$221,924 39
Total of game expenditures	130,653 88

Total

\$352,578 27



3 2044 072 196 033

